

MODERN Machine Shop

HOWARD CAMPBELL, Editor

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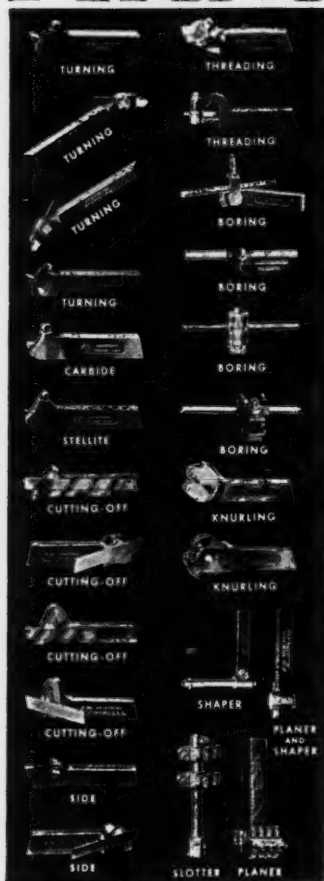
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MODERN Machine Shop

CINCINNATI, OHIO

JANUARY, 1936

VOL. 8, No. 8

Pennsylvania Shops at Columbus are Well Equipped

*Special Tools for Many Jobs—Modern Manufacturing Methods
Adapted to Locomotive Repair Work Produce Results*

BY HOWARD CAMPBELL

THE shops of the Pennsylvania Railroad at Columbus, Ohio, are undoubtedly among the foremost in this country insofar as modern methods of processing, the use of special tools, and safety are concerned. Wherever possible, the machines are grouped according to the work upon which they are engaged for the bulk of the time, thus reducing material-handling to the minimum.

The forged tools are made and tempered by men who have been especially trained for this work. The tool hardening equipment includes several electric and gas furnaces of the size and type best calculated to produce the results desired. Hardened steel bushings and other hardened engine parts are produced here for the entire western part of the system, consequently the lathes and automatic screw machines in which such parts are made and the gas furnaces in which they are carburized and hardened are grouped together in one section of the shop.

This shop has an excellent safety record, due undoubtedly to the fact that the safety campaign is carried on continuously. Each day a new safety slogan is displayed on each of the many safety bulletin boards throughout the shop. Every man in the shop is required to wear goggles continuously while in the shop and this rule applies to everyone enter-



Fig. 1—Combination Drilling and Milling Cutters

ing the shop during working hours. Even callers who may have business in the shop are required to put on goggles before entering. The wisdom of this rule is reflected in the total absence of eye injuries.

Among the special tool designs is one which, while simple, is particularly effective in saving time. This

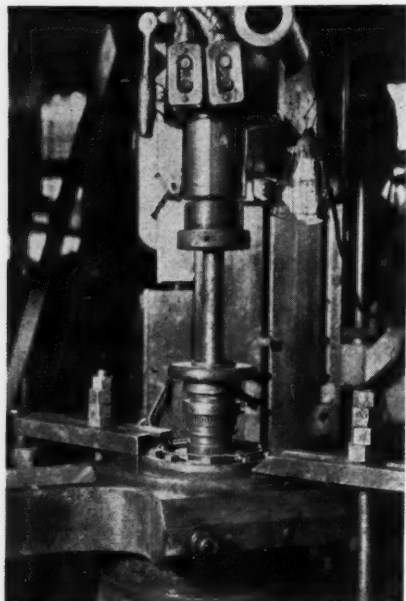


Fig. 2—Using a Hutto Hone and Improved Honing Machine to Recondition a Hardened Steel Liner Bushing

tool is the drilling and milling tool, shown in Fig. 1, with which the ports in the valve bushings are machined. The usual method involves external layout of the ports and then either the drilling of a starting hole for an end mill in each port and milling of the port or having the holes cored for the end mill. If the starting holes are drilled, this is usually done on the milling machine to save handling be-

tween operations and to eliminate extra set-ups.

If the holes are drilled before milling, this involves an extra operation and a change of tools before the milling can proceed. If the ports are cored, it necessitates milling continuously against the scale of the core hole, which is hard on a milling cutter.

The tool illustrated comprises a combination spiral mill and flat drill. The bushing is laid out in the usual manner, excepting that it is laid on the inside instead of the outside, which with the aid of a surface gage is a comparatively simple matter. With the bushing in position on the machine table, the combination tool is fed into the solid wall of the bushing, first drilling a hole through the wall and then being used to mill the outline of the port in the usual manner. Thus the changing of tools is eliminated and the mill is not required to operate against the scale of a core hole. These cutters and all other spiral cutters used in this shop are left hand so that the end thrust set up by the resistance of the metal to the cutter blade tends to force the cutter back into the spindle.

Bearings in main and side rods of the floating bushing type are honed with the Hutto Hone shown in operation in Fig. 2. The machine was formerly a drill press, rebuilt in order to provide both the rotary and reciprocating motions required for honing. The operation shown under way in the illustration is that of reconditioning a hardened steel liner bushing. A nine-stone hone is used for this operation, running at a speed of 50 rpm with 33 oscillations per minute. It is stated that a true hole is produced in this manner while removing a minimum amount of stock. No exceptional skill is required to operate the machine; a first-class job can be turned out by any good mechanic.

One of the most interesting jobs regularly performed in this shop is that of burnishing interiors of cylinder bushings after they have been bored. For this operation the usual cylinder boring equipment, shown in Fig. 3, is required, the heads carrying the rollers being applied after the boring has been completed. The rollers, indicated by arrows in the illustration, are of hardened steel. Using a $1/32$ in. feed and with the spindle revolving at a speed of 6 r.p.m., the rollers are fed through the bushing, producing a smooth, broken-in surface which will not only wear longer but will aid the piston packing to wear longer. The rollers compress the metal between 0.001 in. and 0.002 in. on each side and the operation requires two and one-half hours for a cylinder. However, this extra two and one-half hours is amply compensated for in the smoother action of the piston and longer wear of contacting surfaces.

The burnishing idea is also applied to the finishing of crank pins. Crank pins are turned and burnished in a quartering machine, the burnishing operation being shown in process in Fig. 4. The pins are first turned by the use of a hollow turning head, then the turning tool is removed and the

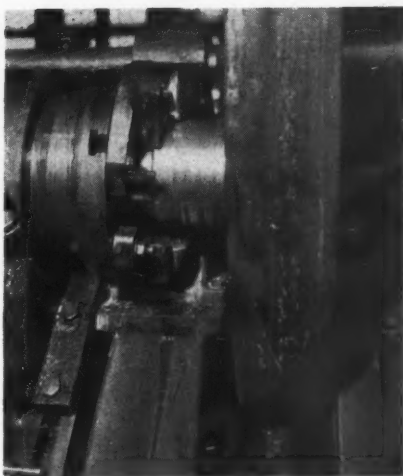


Fig. 4—Crankpins Are Turned and Burnished in the Quartering Machine

wheel is substituted. Using a slow feed and a fairly good rate of speed, the pin is burnished or rolled to size.

The method of turning the crank pins in place described here is said to afford savings in several different directions. For one thing, the wheel centers last longer due to the fact that, inasmuch as fewer pins are pressed out, fewer centers have to be re-bored. A saving is also made due to the fact that it eliminates one operation and, further, machining the pins in the quartering machine in this manner insures perfect alignment of the pins with respect to squareness, throw, and quarter, and thus provides an additional economy. In other words, the refitting of pins is materially reduced.

One of the outstanding economies of the shop consists in the reclamation of sectional piston packing. The packing sections are usually thrown into a box or barrel when they are removed from the pistons and when

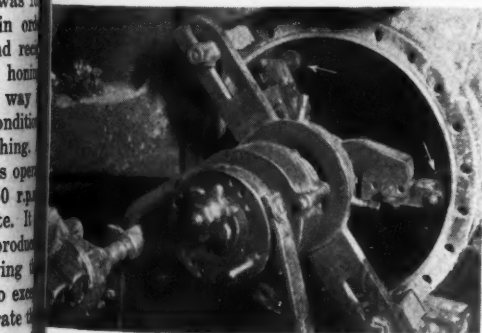


Fig. 3—Using Steel Rollers to Burnish the Interior Surface of a Cylinder Bushing

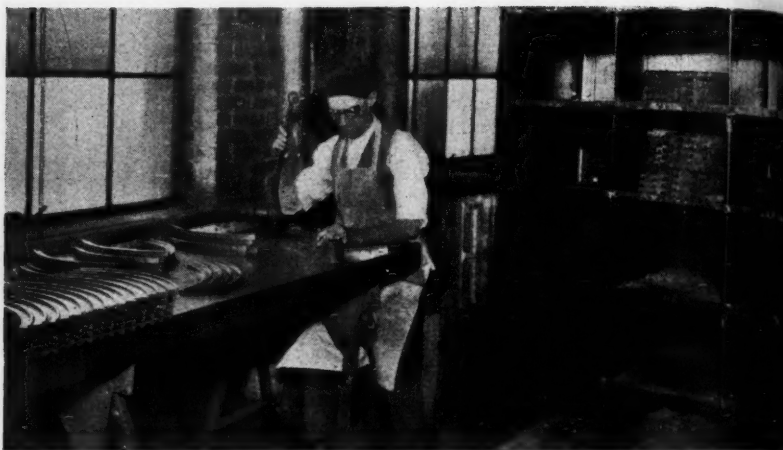


Fig. 5—Sorting and Salvaging Sectional Piston Packing

the receptacles are full they are shipped here to the Columbus shops. Upon receipt at this point, they are delivered to the mechanic shown in Fig. 5, who scraps the sections that are too badly worn or damaged for further use and sorts the good ones according to size. After they have been sorted, he stamps them according to size and the sections are then placed in the boring mill fixture shown in Fig. 6 and are returned to the next smaller sizes. When finished, they are placed in bins as shown in Fig. 5, which are marked according to size. Thus a great deal of piston packing is saved and re-used which otherwise would have been thrown away.

The taper faces of pedestal wedges are ground with the aid of the equipment shown in Fig. 7, this equipment consisting of a Blanchard Surface Grinder and a fixture in which the wedge is held so that the surface will be parallel with the table and with the face of the wheel. In service, the faces of the wedges become marred and worn and the slots for the T-bolts also become badly worn. To reclaim the wedges, each wedge is clamped

into this fixture and the surface is ground sufficiently to remove signs of wear, then the T-bolt slot is built up by welding and is afterward reslotting. Both sides of the wedge are ground to insure smooth, accurate surfaces. The average amount of stock removed amounts to approximately $1/32$ in. A wedge can be ground several times before it will be thinned down to

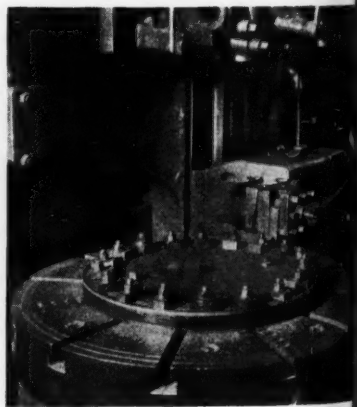


Fig. 6—The Reclaimed Packing is Turned the Next Smaller Size

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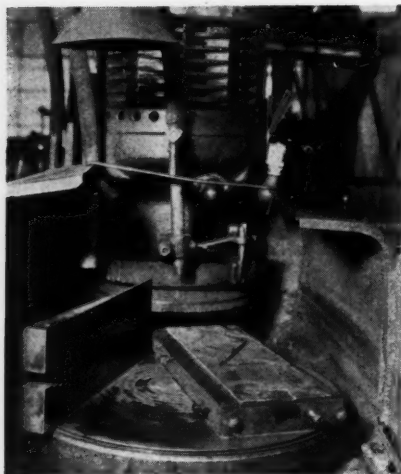


Fig. 7—Faces of Pedestal Wedges are Reground in this Blanchard Surface Grinder

$\frac{1}{8}$ in. on the thin end—which is the “condemning” limit.

In Fig. 8 is shown an interesting tool with which the saddle fits on locomotive cylinders are planed. The cylinder is set up on the table of a planer, as shown, and to the tool slide on the slide head is attached an arm A which is clamped so that it swivels on the bolt B. By shifting the part C on the arm D, any amount of radius desired, within certain limits, can be obtained. With the tool set as shown, the down feed for the side head is thrown in, feeding the tool downward on a radius as the work passes back and forth on the platen. Thus the correct radius is machined on the saddle and a good, smooth job is obtained.

Machining the saddle in this manner eliminates all of the hand chipping and feeding which was done formerly, and produces a very much better job than could possibly be done by hand. If the boiler and frame have been properly aligned, a perfect fit

with the saddle will be obtained. Here is a case where a difficult, dangerous, and expensive hand job was converted into a comparatively simple, accurate, and safe job by forcing the machine to do the work.

The introduction of gas and oil electric railway motor cars has presented a new problem to the railway shop; the maintenance of internal combustion engines and accessory equipment. Among the other tasks that have been turned over to this shop is that of reconditioning crankshafts for these oil-electric engines necessitating the purchase or development of new types of equipment.

The grinding of the crankshaft pins and bearings is performed in the machine shown in Fig. 9, which is a lathe that has been adapted for grinding. A complete new carriage was built in as to afford ample roller bearings for the grinding wheel. The wheel is

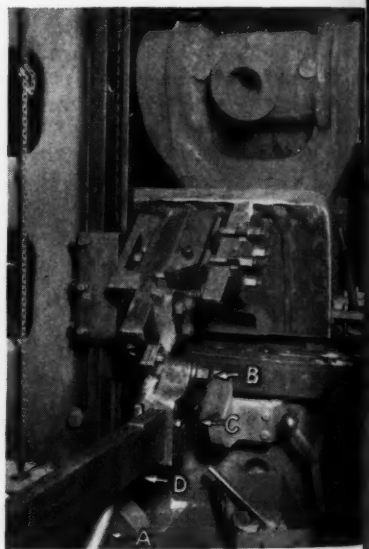


Fig. 8—Planing the Saddle Fit on a Locomotive Cylinder

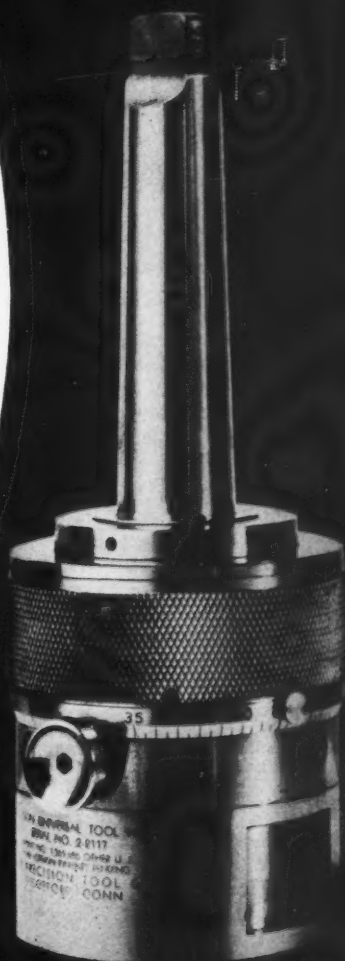
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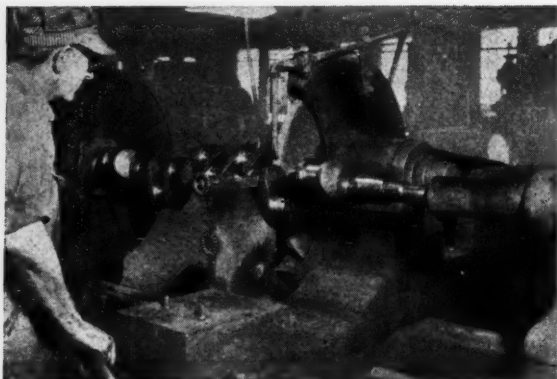


Fig. 9—Regrinding an Internal Combustion Engine Crankshaft

36-in. diameter with a $1\frac{1}{2}$ -in. face. The rear of the carriage extends past the point required for supporting the grinding wheel, however, the extreme rear end of the carriage resting on a rail which is supported at some height from the floor. This extra sup-

port provides stability for the grinding wheel and helps to eliminate vibration. Power is supplied to the wheel from a 10-hp motor on the end of a 5-in. diameter driving shaft which serves as a drum for the grinding wheel belt. This arrangement makes it possible to feed the wheel longitudinally. In order to hold the work in alignment and prevent it from springing away from the grinding operation, a support is anchored to the front of the cross slide, as shown, with a sliding block at the top of the support which is controlled by a hand wheel. The machine serves its purpose admirably.

AUTOMATIC ARC WELDING BY THE ELECTRONIC TORNADO. In this 40-page book The Lincoln Electric Company, Dept. MS, Cleveland, Ohio, tells why the "Electronic Tornado" method of shielded carbon arc welding has developed so rapidly in recent months. It is said that this process practically eliminates the human element and that virtually nothing is done by hand. The arc is automatically struck, shielded and maintained at constant length. The carbon electrode is automatically fed and rotated to preserve a symmetrical point. There are other advantages all of which are outlined in this book.

In addition to a description of the operation, tables are given showing speeds and costs of automatic arc welding by the "Electronic Tornado" process. Photographs show the process in use in manufacturing plants for the making of automobile mufflers, wire wheel hubs, starter and generator frames, chassis frames, rear axle housings, and other parts. A chapter is devoted to the manufacture of pipe by this process, and another to the manufacture of steel barrels. Other chapters show the application of the process in the building of

steel railroad cars and steel ships. Included in the book is a description and illustrations of the equipment required for the process. Copy free upon request.

JARVIS HIGH SPEED ROTARY FILES. This bulletin, issued by The Chas. Jarvis Co., Gildersleeve, Conn., displays the new Jarvis "Ground from the Solid" High Speed Rotary Files in 24 different styles and shapes. The illustrations are made to the actual size of the files, making it easy to select the types required for the work in hand. The files are produced from solid stock. The various shaped blanks are machined and hardened, the final operation consisting of grinding the flutes or teeth into the solid hardened blanks. All Jarvis Rotary Files have an overall length of 18 in. including shank. Copy of the bulletin free upon request.

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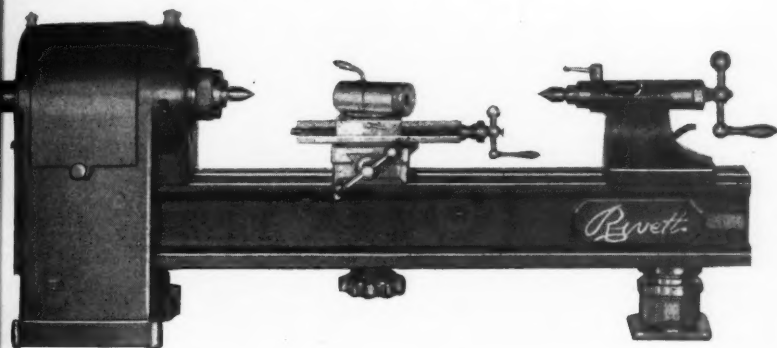
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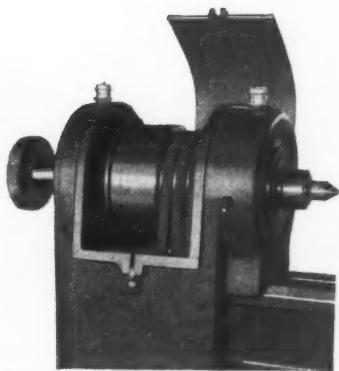


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Typical Applications and Advantages of Alloy Steels

BY N. M. SALKOVER

General Manager, The Queen City Steel Treating Co.,
Cincinnati, Ohio

THE information and data contained in this article are presented chiefly from the heat treater's point of view, because heat treating is its author's business. However, constant contact with metal working plants of many types has shown that metallurgy and the daily routine of machine shop practice should be so thoroughly interrelated that a consideration of one would inevitably include the other. Therefore the following is an attempt to point out, through a discussion of typical applications, some of the advantages available through the use and heat treatment of alloy steels.

Such a presentation might seem superfluous, but in our rather extensive experience with some hundreds of plants we have found a great many manufacturing executives who seemed unable to appreciate the blessings that have been bestowed upon them by metallurgical progress. While aware that modern transportation could scarcely exist if only the "cold rolled", "machinery steel", and "spindle steel" of the past were available, these otherwise competent executives seem to feel that the improved steels

are too difficult to obtain, too expensive, too complex for their own mechanisms.

In this article the writer hopes to show that a number of simple alloy steels are readily available at costs which are not excessive, and with which results can be accomplished that would hardly be possible with plain carbon steels. Only those alloy steels will be mentioned which were regularly carried in stock, ready for

immediate delivery, by a representative Cincinnati steel warehouse August, 1935. The fact that the steels are stocked indicates their general application and wide popularity. Of course many other alloy steels are made regularly by the mills. For certain applications, some of the less widely used materials are superior to those which we are to consider, but naturally they do not belong in a discussion confined to typical warehouse stock.

The following table lists the designations of the alloy steels stocked by the warehouse mentioned, gives their approximate alloy and carbon contents and also their prices compared with those of two plain carbon steels of the "old school", still called "machinery steel" and "cold rolled". The prices given were all quoted August, 1935, and apply in each case to a single sixteen-foot bar of round stock two inches in diameter. Alloy bars were hot rolled with the exception of the one "cold rolled steel" bar.

The steels listed in the table have been divided into three general classes differentiated by carbon content. While all of the alloy materials in each class

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NO TOOL ROOM TOO LARGE**

NO. **44 DUMORE** Toolmaker

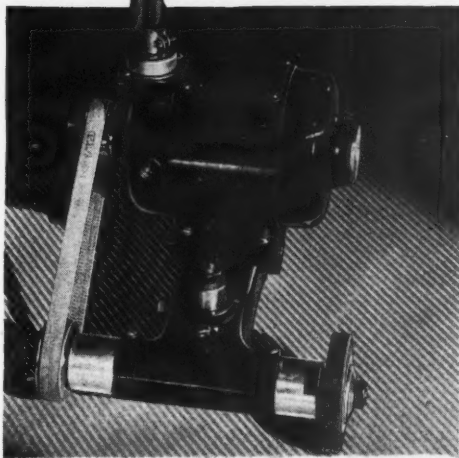
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have, broadly speaking, similar properties, they should not be considered interchangeable. Under some conditions one would be preferable to an-

1. Low Carbon Carburizing Alloys

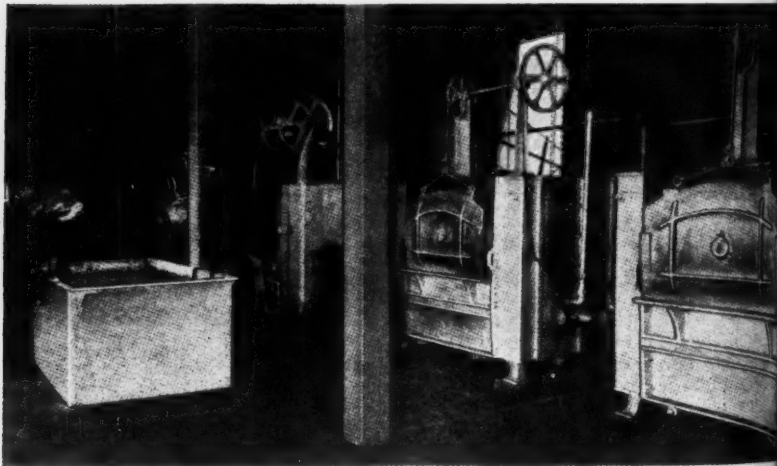
Alloy steels of this type are probably used most extensively for

	SAE Number or Name	Nickel %	Chromium % Vanadium %	Carbon %	Warehouse Price in Cents per Pound
Group No. 1	Low Carbon				
	Machinery Steel			.20	3.82
	Cold Rolled			.20	5.92
	2315	3.5		.15	8.17
Low Carbon	3115	1.25	.60	.15	6.57
	2330	3.5		.30	8.17
	2340	3.5		.40	8.17
	3130	1.25	.60	.30	6.57
Group No. 2	Low Medium				
	Carbon			.40	6.57
	3140	1.25	.60	.40	6.57
	2350	3.5		.50	9.17
Group No. 3	3250	1.75	1.08	.50	9.12
	5145		.95	.45	6.25
	6145		.95	.45	10.22
	Medium Carbon				

other, but for our purposes they will be grouped together.

Naturally all of the comments below apply only to parts which, as a result of operating conditions, require some type of heat treatment.

burized and hardened gears and clutches, particularly for relative high speed operation. It is an interesting fact that the rear axle gears and pinions of practically every automobile built in this country



Section of Queen City Steel Treating Company's Plant Showing Some of the Furnaces.

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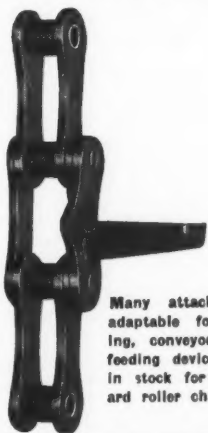
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made of these materials. Transmissions of heavy duty trucks and buses are also made of carburized alloy steels. It is difficult to find gear applications more severe than these.

In machine tools and other machinery in which gears and clutches of good strength, shock resistance and maximum wear resistance coupled with accuracy are required, the low carbon alloy steels seem to be most satisfactory. As compared with plain carbon steels of the carburizing grades, the alloy materials are stronger and tougher. Furthermore, and of particular importance for gearing, they take on high hardness (in excess of Rockwell C 60, by oil quenching, which materially reduces distortion.

Recently fine grained low carbon alloy steels have become available which may be quenched directly into oil from a carburizing temperature of 1650-1700 deg. F. Even after this rather drastic treatment, if preliminary operations have been carried out correctly, extremely little distortion occurs and excellent physical properties are shown by both case and core. In this way practically scale-free hardening, at relatively low cost, is accomplished with very high quality results.

Despite the tough cores of properly carburized alloy steel parts, their impact values seldom equal those of comparable, or at least as comparable as possible, similar parts made of medium carbon or low medium carbon alloy steels. Furthermore, the strength of the higher carbon materials is likely to be somewhat greater. Generally speaking, the carburizing grades of steel wear better but are slightly weaker and more brittle than the other two classes under consideration.

For rolls, bearings of many types, shafts operating under abrasive con-

ditions—in fact, for practically any machine element which must be strong, tough and wear resistant to a high degree—the carburized alloy steels are suitable. It is a well known fact that practically the entire output of one of our largest manufacturers of roller bearings is made of such steels. Used in bearings weighing from less than an ounce up to several tons, the broad use of these materials when properly applied and handled is apparent.

Another important advantage of the carburized alloy steels, as compared with those of the plain carbon type, is their greater uniformity of case hardness. Soft spots are rare in the alloy materials, while as a result of uncontrolled grain size and adhering scale they are far too common in plain carbon carburizing steels.

2. Low Medium Carbon Alloy Steels

These materials, having in the various grades listed permissible carbon contents ranging from .25-.45 per cent, are used generally for parts requiring strength and toughness without great hardness. Familiar examples in the automotive field would be crankshafts, connecting rods, connecting rod bolts, drive shafts, axles and steering linkage. Airplane engine crankshafts are made quite extensively of SAE 3140, although SAE 3145, which we do not list, is sometimes used.

The rear axles of heavy trucks are generally of SAE 3240. A common method of fabricating parts made of these steels is to carry out all, or at least the finishing, machining operations after heat treating. The rolled bar or forging or rough turned piece is heat treated to a hardness (generally between 275-350 Brinell) which will permit machining at commercial rates, but which nevertheless re-

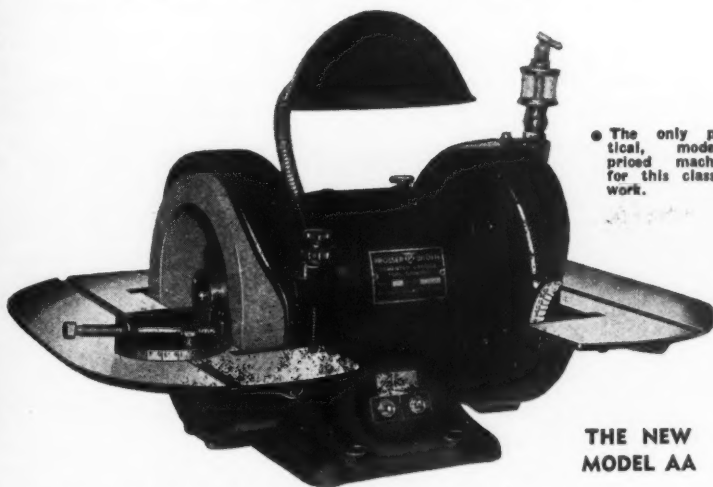
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including two 7" silicon carbide cup wheels, combination protractor, and adjustable light. For 110v, 60 cycle A. C.; motors for other currents can be furnished.

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Model "A"—Equipped with straight roughing wheel for rapid metal removal, plus a diamond or silicon carbide cup wheel with table, for finishing.

Model "B"—A light machine for grinding bits up to and including $\frac{1}{2}$ " square. Includes two 3" cup wheels and tables. Diamond wheels may be used if desired.

Model "C"—Roughing Grinder. Equipped with two first quality 6" straight wheels—one for backing off steel shanks—one for roughing down badly worn or broken cemented carbide tips.

The New Model "AA" is a two table machine. Used in conjunction with the model "C" Grinder (see description at right) it comprises the most complete equipment for grinding Widia and other cemented carbide tools available at moderate price. This new machine will grind cemented carbide tools at a cost lower than has ever before been possible. It will pay for itself in short order by—1. Saving cemented carbide by reducing breakage and waste. 2. By increasing tool life between grinds. This machine is also excellent for general tool room and general shop use, when equipped with suitable wheels.

Prosser Widia Cemented Carbide Tool Grinders provide fast rough-grinding; smooth, keen finish-grinding; flat surfaces, and accurate angles. Finishing wheels may be either fine grain silicon carbide, or diamond impregnated for the ultimate in finish and speed. Correct lubrication is furnished for the diamond wheels. Motors are ballbearing and just proof with thrust washers to prevent end play. The quick-setting tables are carefully planed and slotted, and have graduated indexes.

Grinders will be shipped subject to approval.

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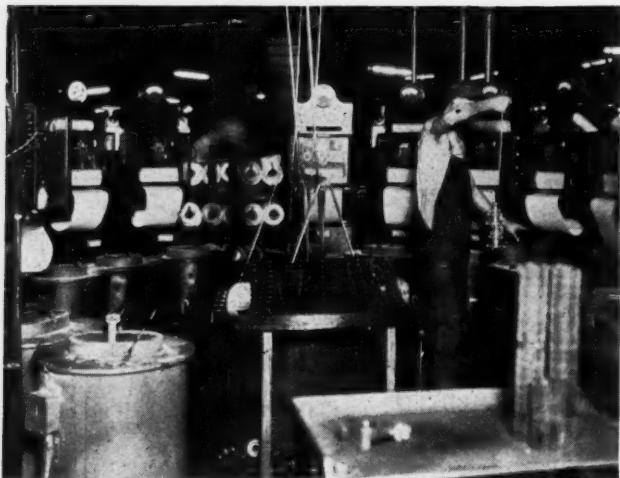
excellent strength and toughness to the finished parts. Many automotive units are handled in this manner. Since all machining operations are performed after heat treating, distortion is eliminated and surface finish is not affected.

Transmission gears for passenger cars are made rather generally of steels of this type having a carbon

bolts—in fact, innumerable parts highly stressed in service, but usually failing through wear—are the logical places for the low medium carbon alloy steels. They have many important points of superiority over ordinary plain carbon steels for such service.

Plain carbon steels, except in sections under—let us say roughly—

$\frac{1}{2}$ in., are very definitely water hardening. In fact, we have had quite a lot of difficulty in obtaining absolute uniformity of hardness under first rate commercial conditions in the oil quenching of pins $\frac{3}{8}$ -in. diameter and made of a 1.00 per cent tool steel. Even water quenching carbon steels having a carbon content less than .5 per cent is likely to produce inconsistent results.



A Group of Electric Hardening Furnaces in a Gear Manufacturing Plant

content around .35 per cent, and hardened by heating entirely in a cyanide bath, or by heating first in another furnace and then transferring to a cyanide bath for a short period. The very thin hard case produced by the cyanide treatment seems to resist pitting, which is the common cause of motor car gear failures. As far as we know, such treatments are not used widely outside of the automotive industry.

From the examples given it is probably a simple matter to visualize the proper field for this steel classification in general machinery construction. Shafts, spindles, studs,

because these steels require a very clean quench, with practically no adhering scale or steam pocket formation. They are, in their customary analyses, very sensitive to slight reductions in quenching speed. They also are subject to cracking if too drastic a quench is used. Even though, by means of a water quench, proper hardness might be obtained without visible cracking, there would still remain the distortion problem, shallow hardening in sections of any size, and the possible formation of microscopic or sub-microscopic cracks with ultimate failure in service.

Of the steels listed under the low

grind, less lost time for resetting and reduced tool maintenance are assured users of Sunoco.

In addition, Sunoco will aid in increasing the amount of metal removed per unit of time and still maintain accuracy and finish.

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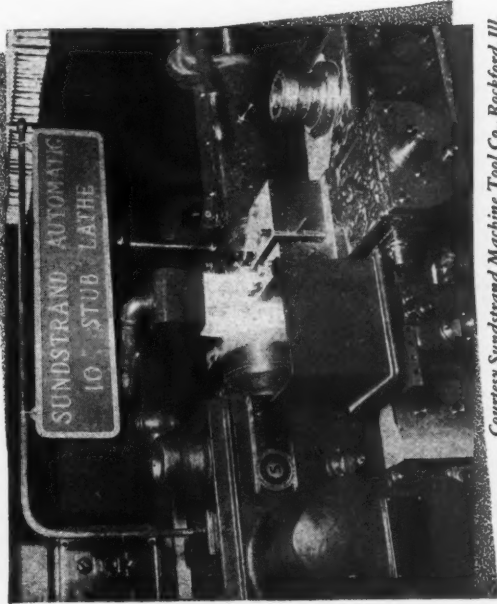
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CUTTING OIL

SUN OIL COMPANY, PHILADELPHIA, U.S.A.

Subsidiary Companies: Sun Oil Company, Ltd., Montreal, Toronto
British Sun Oil Company, Ltd., London, England

Courtesy of Lodge & Shipley Machine Tool Co., Cincinnati, O.

Operation: Rough turn, face and taper of valve stem.
Machine: Lodge & Shipley High Speed Lathe.
Material: Bronze Castings, 1-1/16 Dia.
Spindle Speed: 2400 R.P.M.
Feed: 0.18"
Cutting Speed: 665' per minute.
Depth of Cut: .0625" (1/16")
Cutting Lubricant: 1 part Sunoco to 20 parts water.



Courtesy Sundstrand Machine Tool Co., Rockford, Ill.

Operation: Rough turn, face, chamber and form tractor cluster gear-7 tools.
Material: Steel Forging S.A.E. 10-10.
Spindle Speed: 90 R.P.M.; S.F.P.M. 120'.
Feed: .014 per revolution.
Cutting Lubricant: 1 part Sunoco to 20 parts water.

medium carbon alloy classification, only SAE 3130 is frequently water quenched. All of the others are clearly of the oil hardening type, with all the advantages resulting from the more gentle quench. SAE 3130 is used chiefly for small bolts and studs of simple section, and probably as a result of high quality alloy steel-making practice, such applications work out very well.

We occasionally receive a lot of bolts or shafts, made of SAE 1112 (screw stock) or SAE 1015, with a request that we strengthen and toughen them. Unfortunately the heat treater can do very little with such materials. It is, of course, a simple matter to increase surface hardness, but to effect a worthwhile increase in strength or toughness is hardly possible. This is the logical field for the low medium carbon steels.

3. Medium Carbon Alloy Steels

Medium carbon alloy steels have a very broad range of application in machinery construction generally. Such a steel combines high strength and toughness with considerable hardness enabling it to resist wear. The low carbon carburizing grades of alloy steels are undoubtedly superior to these medium carbon types under conditions of unusually severe abrasion and high speeds; however, the medium carbon alloys are the next step downward in wear resistance. The great majority of the machine tools built in this territory are equipped with gears made of medium carbon alloy steels. Some of these gears are heat treated after finish machining, then lapped or ground, while others are heat treated after roughing and finished in the heat treated condition.

From the application point of view, excepting automotive gears hardened by cyanide immersion, steels of the low medium carbon alloy type are used chiefly where strength and

toughness, but little wear resistance are required. Steels of the medium carbon alloy type are also excellent from the points of strength and toughness, while their higher carbon content provides wear resistance not found in the low medium carbon group.

A number of months ago our plant hardened forty-two ring gears, each more than 50 in. in diameter and with 8-in. faces, made for use on electric locomotives. These gears, made of SAE 3250, were finished before heat treating, and after hardening to an intermediate Brinell they are doing extremely well in service. Fairly recently we hardened the head gears made of this same steel, for a special 100 h.p. lathe designed to demonstrate the maximum potentialities of cemented carbide cutting tools. Results have been entirely up to expectations. The above examples are cited to indicate the severe service to which the common medium carbon alloy steels can be subjected successfully. It is hardly possible to compare these steels with the plain carbon materials of similar carbon contents; the difference in strength is so marked that there is really no competition.

Alloy steels have been with us for a good many years, but it has been our experience that many otherwise progressive shops utilize them very little or not at all. Practically every present-day mechanism would be improved by a judicious use of alloy structural steels. Broadly speaking, advantages to be gained are—from the heat treating point of view—greater uniformity of hardness and less distortion. From the mechanical point of view, higher strength, endurance limit, toughness, wear resistance, uniformity and dependability. Modern steel sales organizations generally have engineers competent to assist prospective users in the selection of steels for specific applications.

In 1936 specify ROSS VALVES

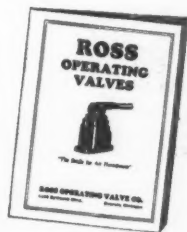
"the bridle for air horsepower"

Dependable, accurate, positive air control over a long period of service is provided with Ross Valves. A few air valves in the Ross Line are presented here.

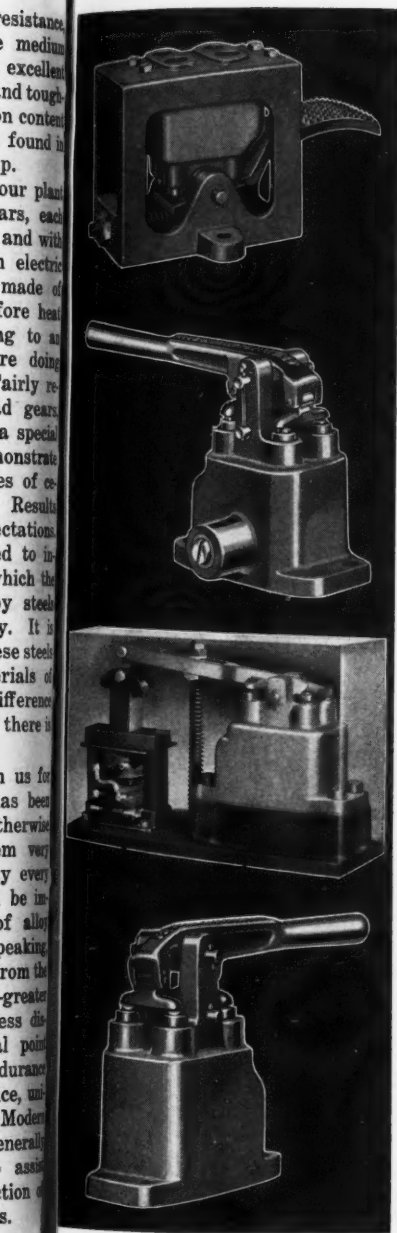
Above is the Model S. T. Non-locking foot valve for the control of single and double acting cylinders. Next is the new two pressure valve which provides full line pressure on the work stroke and selected reduced pressure on the idling stroke. Ross Solenoid Controlled Valve is shown next . . . the valve that is adaptable for mounting adjacent to cylinders and is operated electrically with finger tip control. At the bottom is the reliable Ross four way hand control valve for double acting cylinders.

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Methods Engineering Procedure: Time Study

In this, the fourth article of the series, the author explains the making and recording of a time study.

By H. B. MAYNARD

President, Methods Engineering Council, Inc., Pittsburgh, Pa.

THE term "time study" as it is commonly used includes, in addition to the study of the time required to perform the operation, job analysis and such methods study as can be

study of the time required to perform an operation after the method has been established.

In actual practice, the methods engineer gives some attention to the method when making his final time studies but he does not concentrate on the method as much as when making his analysis and motion study. The time study is generally made for rate setting purposes and is the most valuable tool of the methods engineer in this connection.

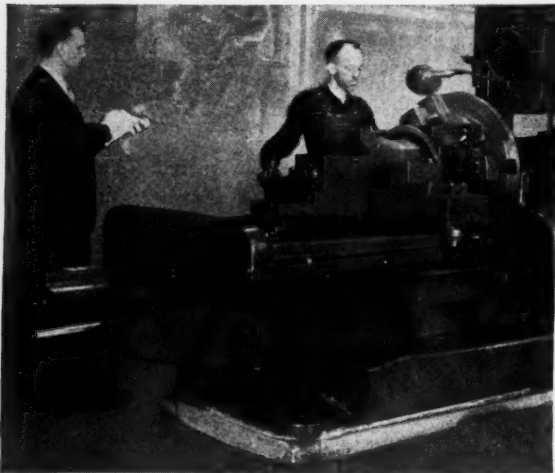


Fig. 1—Methods Engineer Making a Time Study of a Lathe Operation

made by considering elemental operations which for the most part are composed of several basic divisions of accomplishments. For the purpose of this article, however, the term "time study" will be used to cover only the

rare indeed that subsequent time study brings to light further improvements. The interest of the methods engineer lies now in determining the proper time which should be allowed for doing the job. His aim is to

Elements of Time Study

It will be assumed that the best method for doing a job has previously been worked out. If the job has been subjected to careful motion study, this is a safe assumption, for it is

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establish the time in which the man of average skill working with an average effort under average conditions can perform the operation. Some incentive systems require the establishment of a time value for other than the average performance, but these are by far in the minority. When they are used, it is a matter of simple arithmetic to adjust the time determined by the technique which will be described to the required performance level.

It must be borne in mind that the average performance so often referred to by methods engineers is not the average performance of a heterogeneous group selected at random, but is the average of a selected group of men who are sufficiently skilled at a given operation or trade to enable them to work on it satisfactorily. The man whose performance is rated as average is the man who has been working on a given class of work long enough to know it thoroughly, who is fitted for the work by nature, and who possesses normal intelligence and enough education to perform satisfactorily the work at hand. An average laborer and an average tool maker are, of course, two different types, and the length of time necessary to learn a job thoroughly may vary from a few hours for a dipper in a paint shop to several years for an all around machinist who is skilled in using all

types of machine tools.

Figure 2 presents a graphic analysis of the elements of time study proper. The first step in studying any job is to choose the operator who is to be studied. If only one operator is doing the job, there is no choice of course, but where several operators are doing the same work, it is

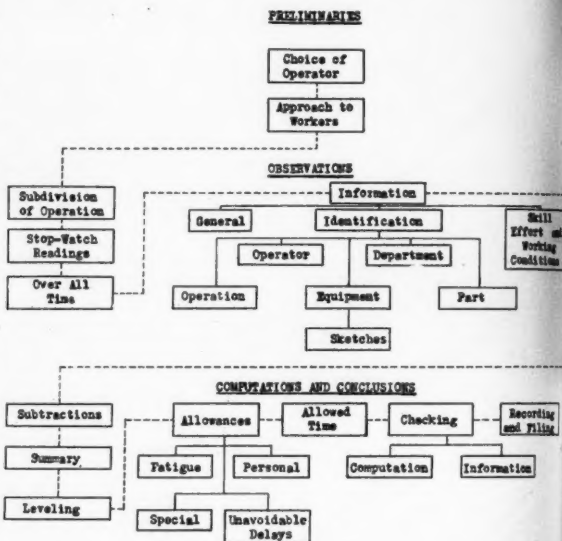


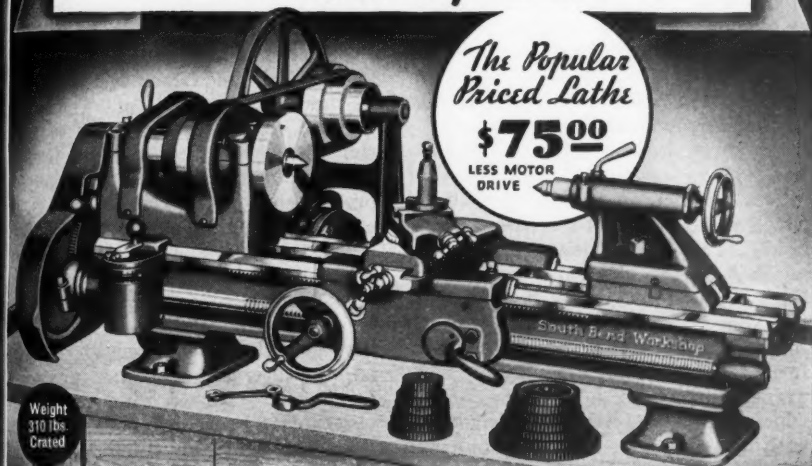
Fig. 2—Graphic Analysis of the Elements of Time Study

usually best to study the one who is most intelligent and most likely to be cooperative during the study.

The manner in which the operator is approached at the beginning of the study is important, particularly if he is not accustomed to being studied. The methods engineer tries in his approach to be courteous and unassuming and shows a recognition and respect for the problems of the worker. He is frank in his dealing with the man and is willing to explain what he is doing and how he does it at any time.

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and suspicion of a man more quickly than an air of secretiveness or an unwillingness to exhibit and explain any data during the course of a study. The trained methods engineer is exceedingly careful to avoid an attitude of this kind. He is dealing with facts, and he has nothing to hide. Indeed, from his viewpoint, his work would be easiest if all of the men whom he studied were familiar with the details of time study technique.

The first step in making observations is to subdivide the operation into a number of smaller operations which will be studied and timed separately. These subdivisions are known as elements or elemental operations. Each element is exactly defined in a few well chosen words which are recorded at the top of the observation form. The sample time study, Figure 3, illustrates all of the points which will be described in connection with time study observations and should be referred to by the reader as each point is brought out.

The division of the job into its elemental operations must be clean cut and sharply drawn, so that when the watch readings are being recorded, the chances of overlapping will be minimized. If the elemental operations are lined up properly, one who is familiar with the class of work should be able to visualize every step of the operation merely by reading over the list.

It requires some little practice to make and record watch readings correctly, and concentration must be developed to the point where it becomes a habit. When making a study, the observer remains inconspicuously in the background so as to disturb the operator as little as possible.

The operation is timed with the aid of a stop watch, of which there are several types. There are also several methods which have been developed

for recording watch readings. The observations recorded on Figure 3 were made using an hour decimal stop watch which reads directly in ten thousandths of an hour and were recorded using what is known as the continuous method of recording watch readings. The watch runs continuously from the beginning of the study to the end, and thus every moment of time is accounted for. The watch is read at the termination of each elemental operation, and the reading is recorded in the R column under the proper element description.

The elapsed time for each element is secured by subtracting successive readings, which is done after the observations have been completed. The hour decimal watch and the observation procedure described give results as accurate as any other procedure and more accurate than most. The observation procedure is the most satisfactory from the standpoint of the inquiring worker in that it shows just exactly what went on during the study and accounts for all operations and time in a manner which leaves no room for doubt.

Occasionally variations from the regular sequence of elemental operations occur which the methods engineer must be prepared to handle and record without confusion. Variations may be divided into four general classes:

Elements performed out of regular order.

Elements missed by the observer.

Elements omitted by the operator.

Foreign elements.

The first three are self explanatory. Foreign elements are elements for which no provision was made at the time the sequence of elements was determined. Sometimes these foreign elements are necessary to the job and sometimes they are not. They can occur between the end of one

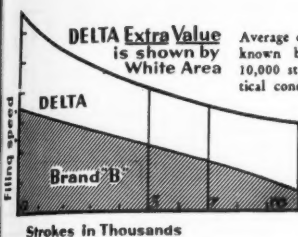
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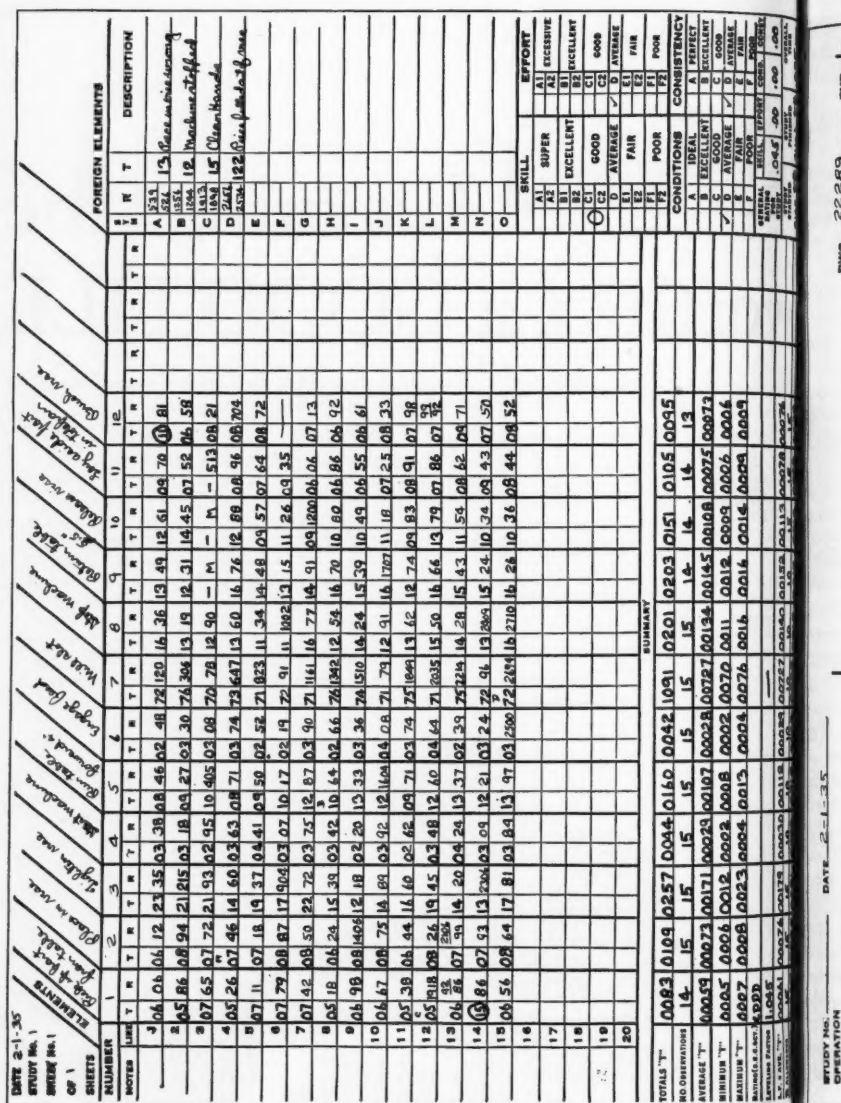


Fig. 3—Time Study of a Simple Milling Machine Operation

regular element and the beginning of the next, or they can occur while a regular element is in progress. Fig-

ure 3 shows examples of all classes of variations from regular sequences. The simple and logical manner in which

of the observation sheet. From these the overall elapsed time for the duration of the time study is computed. It should be equal to the sum of all of the detail times, foreign operations, and delays, and when checked with the final stop watch reading, will give a rough check of the accuracy of the stop watch.

A time study, to be of value for future use, must tell the whole story of a job in such a way that it will be understood at any time in the future by anyone familiar with the time study methods. This will not be possible unless all observations have been recorded in a clear systematic manner and unless all identifying and other pertinent information is recorded at the time the study is made. Provision is made on the back of the sheet for such data.

Records should be made to show complete identifications of the operation, the part or piece of apparatus, the machines, tools, and equipment used, the operation, and the department in which the operation was performed. Sketches, for which space is provided, are generally a desirable and satisfactory adjunct to verbal descriptions. The importance of recording information completely is paramount and cannot be too highly stressed.

The Leveling Principle

The object of the time study, as has previously been stated, is to determine the time which the man giving an average performance will require to do the job under average conditions. If all workers available for study gave this performance, the task would be easy, for it would then merely be necessary to average the elapsed times determined by observation and add an allowance for personal and unavoidable delays, fatigue, and so on. No two operators, how-

ever, are consistently, if ever, of equal ability, and it is seldom that a performance that can be rated throughout as average is encountered.

Different operators possess varying degrees of skill and consequently will differ in the effort which they give. Therefore in order that the time standard established from a time study may be true standard on the basis of average performance, it is necessary to use some method of adjustment of the recorded elemental times to arrive at the desired time standard when other than an average performance is observed. The method of adjustment which best accomplishes this is known as the leveling method.

Suppose, for a moment, that it is possible to find a man giving an average performance working on an operation which it is desired to study. This man will possess average skill and will work with an average effort. Assuming that conditions are average, the times for each elemental operation obtained from a study of this man will be the standard times which it is desired to determine. The study will be taken on a number of pieces, and while the time value determined for a given elemental operation will not be exactly the same for every piece because of minor differences impossible to detect, the average of these times, after abnormal values have been set aside, will give the time for that elemental operation which the operator may be expected to meet consistently. In other words, the average will determine the plane along which the operator possessing average skill will work continuously while giving an average effort. The time values for all operations in the shop should be along this plane.

In most cases, however, it will not be possible to find an average performance. Suppose, rather, that it is

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necessary to study a man who, although working with an average effort, possesses good skill. Because of this higher degree of skill, the average times for the various elemental operations determined by the study will be lower than those obtained from a study of an average performance; that is to say, the man possessing good skill will work along a higher plane than will the man of average skill.

Skill, effort, and conditions all influence the level at which the operator works. They are judged during the actual making of the study. There are six degrees of skill and six degrees of effort recognized by the methods engineer. Each of these has been defined and the characteristics which are likely to be exhibited when a given degree of skill or effort is exerted have been listed after careful research. Thus the judgment of the methods engineer is guided by these definitions and descriptions, with the result that ratings are accurately and consistently made.

Conditions to be considered are those that affect the operator and not those that affect the method. A clogged water line on a tool grinder which makes it necessary for a lathe operator to walk 200 feet to secure a pail of water before he can grind his tool is undoubtedly a poor condition in one sense of the word, but a large portion of the method followed in the operation of "grind tool" is changed. No leveling factor can be devised which will cover conditions of this kind. The conditions which the methods engineer thinks of when he uses the word are those conditions which affect the skill or effort of the operator when he is following the correct method.

On a Monday morning in winter, for example, the shop may be unusually cold. The operator's hands

will be stiff, and he will be retarded in his work to some extent. His proficiency will be reduced, but it is better clearly to attribute this to poor conditions rather than to reduce his skill rating. On at least 90 per cent of all time studies, conditions are rated as average.

Consistency is rated after the elemental elapsed times have been determined by subtraction and is judged by the extent of the difference between the maximum and the minimum values recorded from each element. A study which shows perfect consistency is seldom if ever obtained. Even when a mechanically-controlled operation which is of the same length during each cycle is timed, errors in observing and the fact that the watch is read to only the nearest 0.0001 hour will cause inconsistencies.

In most actual cases, a consistency rating of 0.00 is used. Better consistencies do not occur in the majority of cases, and if observed readings are exceptionally inconsistent, it is usually a sign that something is wrong with the observer, the operator, or the operation. This should be investigated instead of attempting to correct the data by using a poor consistency rating.

The four factors of skill, effort, conditions, and consistency determine definitely along what performance plane any operator works at any time. When this plane has been located, there is a simple mathematical process for bringing the time values determined from any study down or up to the desired average level.

Working Up the Study

Skill, effort, and conditions are rated either while the time study observations are being made or immediately after. Identifying and other information is then recorded, usually while still at the work station where

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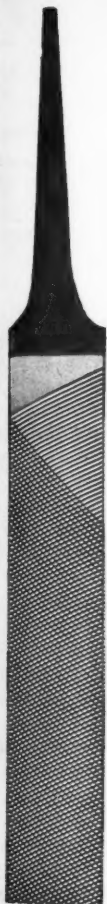
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the job is done. The balance of the work on the study, called in shop parlance "working up the study" is done at the desk.

Elapsed times are determined by subtracting successive watch readings. Each subtraction is recorded

will be obvious at a glance, and doubtful cases will not cause sufficient variation to change the result materially whether the values are admitted or not.

The remaining elapsed times for each element are added and are averaged

Skill			Effort		
+0.15	A1	Superskill	+0.13	A1	Excessive
+0.13	A2		+0.12	A2	
+0.11	B1		+0.10	B1	
+0.10	B2	Excellent	+0.08	B2	Excellent
+0.06	C1		+0.05	C1	
+0.03	C2	Good	+0.02	C2	Good
0.00	D		0.00	D	
-0.05	E1	Average	-0.04	E1	Average
-0.10	E2		-0.08	E2	
-0.16	F1	Fair	-0.12	F1	Fair
-0.22	F2		-0.17	F2	
-0.22	F2	Poor			Poor

Conditions			Consistency		
+0.06	A	Ideal	+0.04	A	Perfect
+0.04	B	Excellent	+0.03	B	Excellent
+0.02	C	Good	+0.01	C	Good
0.00	D	Average	0.00	D	Average
-0.03	E	Fair	-0.02	E	Fair
-0.07	F	Poor	-0.04	F	Poor

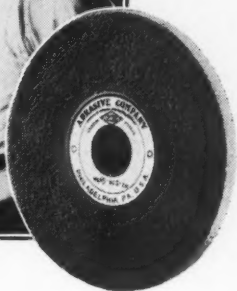
Fig. 5—Performance Rating Table

between the two watch readings that determine its value. Elapsed time is noted in ink both to insure a permanent record and to distinguish it from the watch readings, which are usually recorded in pencil.

The study is next carefully examined for abnormal values. If any are found, they are marked so that they can be distinguished and excluded from the summary. Picking out the abnormal values is largely a matter of judgment in which there is little likelihood of error, for extreme cases

aged by dividing by the number of occurrences. The results are average elapsed times which represent the performance level of the operator on that particular study. The times are adjusted by multiplying them by a leveling factor which is determined by the rating of skill, effort, conditions, and consistency in accordance with the Performance Rating Table, Figure 5. The values given in the table have been independently checked by several industries and may be accepted as being correct. The al-

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braic sum of the numerical values taken from the table added to 1.0 gives the leveling factor. Each average elapsed time is multiplied by the leveling factor, and the result is recorded on the eighth line of the summary.

If workers were able to work continuously, the leveled time would be the correct value to allow, but constant application to the job is neither possible nor desirable. In the course of a day, there are certain to be occasional interruptions and delays, for which due allowance must be made in establishing the time value. Each elemental operation is considered separately, and is increased by an allowance which covers time which will be consumed by personal and unavoidable delays, fatigue, and any special factors which may affect the job under consideration.

The numbers and descriptions of the elemental operations are transcribed on the back of the observation sheet. Future reference will be made most frequently to this part of the time study. Descriptions of the elemental operations are elaborated upon where clearness will be gained. The time allowed for each elemental operation is transcribed in the column reserved for that purpose. In the next column to the right is noted the number of times the elemental operation occurs on the piece or cycle of the operation. Extensions of the total time allowed for each element are made and recorded in the last column. The allowed times for elemental operations that occur but once are recorded only in the Time Allowed Column. The allowed time for the operation is the sum of the amounts recorded in the last or Time Allowed Column.

The time study procedure which has been described is applicable to studies made upon set-up or one piece opera-

tions as well as on repetitive operations, for the leveling principle can be applied in all cases. In plants doing work of a miscellaneous and variable nature where quantities are small and set-ups frequent, this point is important.

ALLIS-CHALMERS TEXROPE DRIVES

In this 32-page book, profusely illustrated with photographs of various kinds of machine tools employing Texrope Drives with the drives shown in color, the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., presents the complete story of the Texrope Drive, its applications and advantages. In this book will be found the reasons why the Texrope Drive has made its way so rapidly to the front during the last few years. All types and varieties of applications are shown, and each application is described.

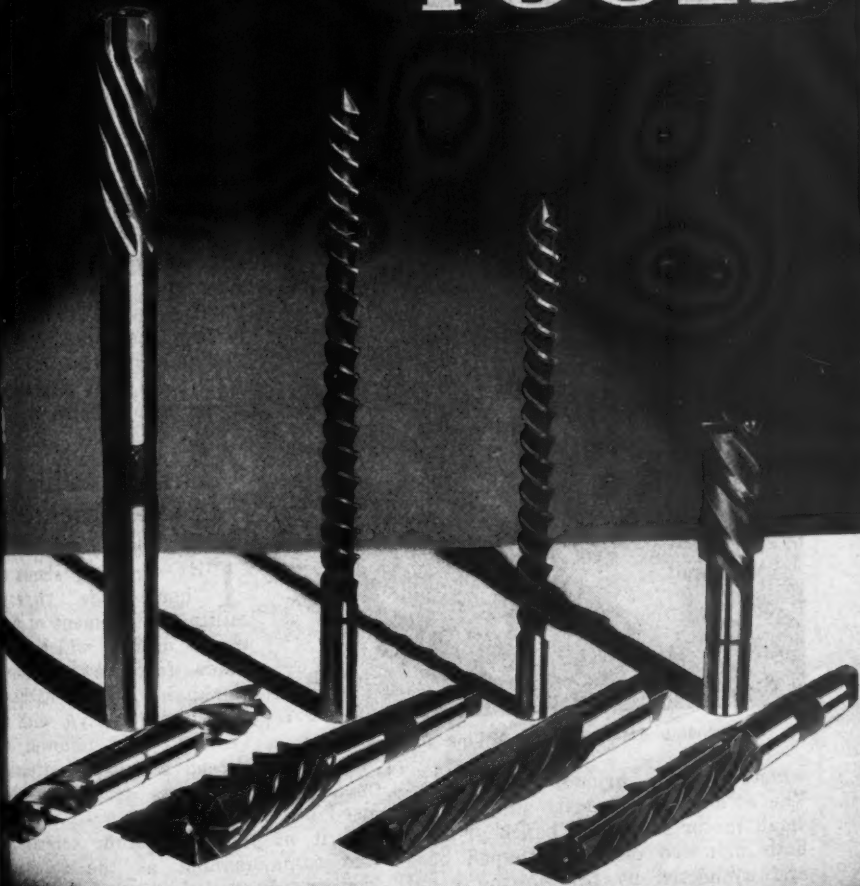
In addition to the illustrations and descriptions of applications of the drive, the drive mechanism itself is described in detail. A copy of this book is available to any mechanical engineer or executive upon request.

FARREL-SYKES GEAR GENERATORS

Included in this 52-page book is complete information regarding the applications and advantages of Sykes Gear Generating Machines. The process of cutting continuous tooth double helical gears, cluster gears, internal gears, worms and spiral gears, racks, and all other types of gears is described in detail and the text is amply illustrated with photographs and drawings.

The book gives a resume of the development of Sykes Gear Generators, and a chapter is devoted to "Discoveries in Gear Cutting of Scientific Interest." The principle of action employed in the Sykes Gear Generator is clearly outlined so that the engineer who is not familiar with this machine may understand perfectly how it operates and what advantages it has to offer in the production of gears of all types and kinds. The latter part of the book is devoted to illustrations and specifications of the different types and sizes of Sykes Gear Generating Machines, together with instructions for setting up and operating the different machines. A copy of this book is available to any engineer or plant executive upon request. Address Farrel-Birmingham Co. Inc., 381 Vulcan St., Buffalo, N. Y.

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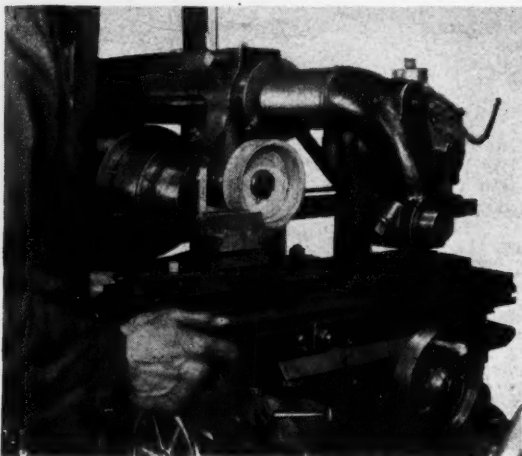
Ideas from Readers

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . Each one published will be paid for.

Grinding Attachment for Milling Machine

By Jos. C. COYLE

THE illustration shows how a jobbing shop converts a milling machine into a grinder for small work



Grinding Attachment for Milling Machine

when no other grinder is available. The attachment consists simply of a small motor and small bench grinder, both mounted on an L-shaped base and connected by belt in the usual manner. The object of mounting it on the milling machine is so that the machine table may be used to feed the work past the wheel, thus providing accuracy together with the advantages of hand and power feed.

The motor is mounted on the wide end of the base, in either side of

which centerholes are provided to receive centers inserted into the spindle and arbor bearing hole in the overarm. The base is further steadied by the use of a section of bar stock with a circular hinged clamp at the top which encircles the overarm. The

grinder is located on the long end of the base.

By using a fixture as shown, the attachment is particularly useful for beveling or otherwise grinding small work.

Thread Milling Attachment

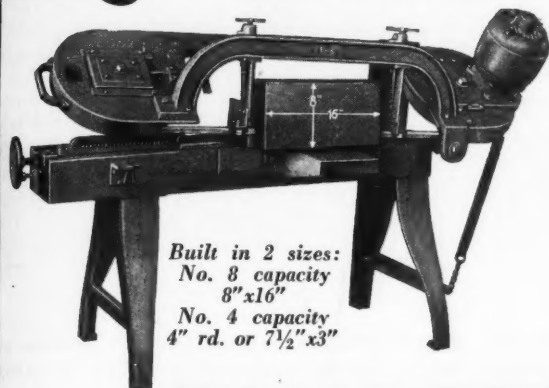
By JOHN JERGENS

THE drawing shows a "home-made" thread milling attachment of unusual design which was made for use on either the hand screw machine or turret lathe with leader and follower thread chasing attachment.

The tool was designed to be used on the hexagon turret, anchoring it in place with four screws in the same manner as the standard equipment which is used on the turret.

The attachment consists of a base carrying a cross slide in which the spindle is mounted. A motor, mounted on the top of the attachment, supplies the power, which is transmitted to the spindle by means of a V-belt. The parts of the attachment are of cast iron excepting the spindle, cross slide

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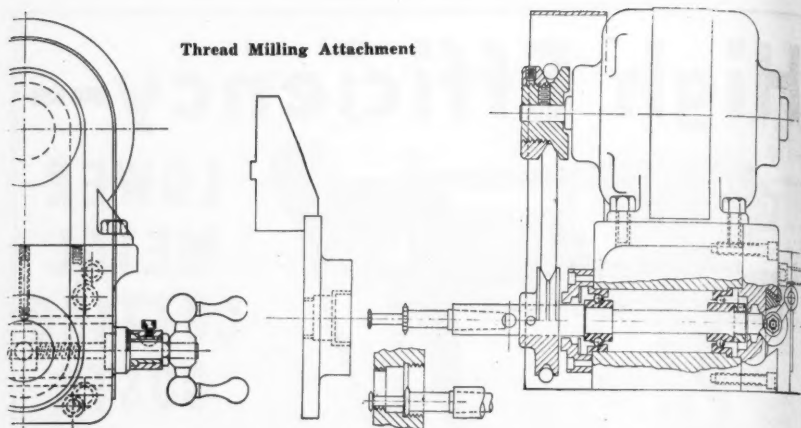
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feed screw, and nut for the screw. The spindle, which is of steel, is hardened and ground all over and mounted in New Departure flanged precision spindle bearings. A graduated dial on the cross slide screw provides for fine adjustment of the milling tool.

A taper hole in the spindle provides for insertion of the arbor upon which the thread milling cutter is mounted. By changing the pulleys so as to provide the desired speed, the attachment may be used for performing a variety of other operations where taper shank tools can be used. The illustration shows the attachment equipped with two cutters for milling two threads simultaneously.

Interchangeable Mechanism For Guiding a Slide in a Rectangular Path

By J. E. FENNO

AN unusual mechanism is employed in one woodworking machine for guiding the work in a square or rectangular path for performing a mortising operation. This mechanism, shown in the illustration, is in-

terchangeable; that is, mortises of various sizes can be made by merely changing the guiding cam.

The cam is indicated at A. It is fastened to the machine and consists of a cast iron plate having a continuous groove the contour of which is similar to the outline of mortise to be cut. A square follower B engages this groove and is free fit on the lower end of the demountable pin C. Incidentally, the movements of the center of the follower and of the work are identical.

Pin C is secured by set screw D, in head E which slides in guide ways in the arm F. Arm F is keyed to the driving shaft G supported in the machine bearing. At the upper end of pin C is pivoted the arm H which is an integral part of the work slide J. The guide way for this slide forms a slide in itself and is mounted in the stationary guide way L. Thus, with this compound slide arrangement, the work (not shown), which is fastened to slide J, can be moved in any direction in one plane by the cam action to be explained.

As the driving shaft G rotates (in either direction) arm F forces the follower B along in a straight path

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you're doing every minute. That's why I like Starrett Tools. When I read a Starrett mike or a Starrett dial indicator I know just where I stand."

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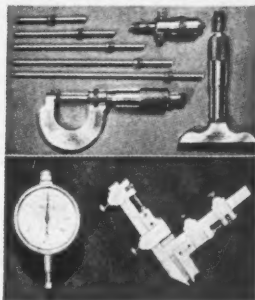
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one of the adjacent corners of the cam. Continuing the movement of the arm, the follower is constrained to immediately change the direction of its motion and travel in a straight path to the next corner. In this way, the direction of motion of the follower is changed successively at each corner so that the follower moves in a perfect rectangular path.

The variation in the radial position of the follower is compensated for by the sliding action of the head E in the arm F. Since the compound slide arrangement permits only a parallel motion of the work slide, the motion of the latter will be exactly the same as that of the center of the follower. Consequently, to obtain the overall dimensions of the cam grooves, the thickness of the follower must be added to the dimensions of the rectangular path to be followed by the work.

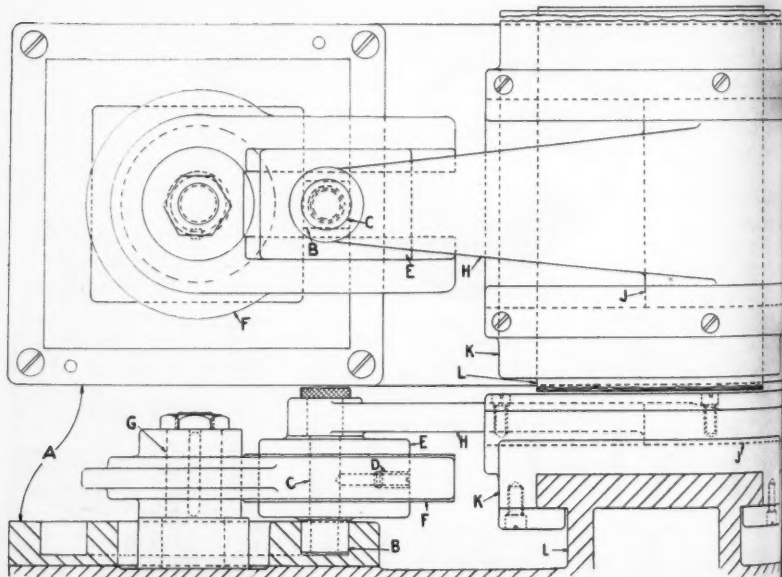
For mortises having curved outlines the cams may be made to conform, but instead of a square follower a roll is used. In changing over the cams, set screw D is loosened and pin C removed. Arm F is then dismounted from its shaft to permit accessibility in removing and replacing the cam. Very little time is required for making this change.

The mechanism described is also adapted to polishing machines for guiding the polishing wheel along irregular endless contours.

Tool For Machining at Right Angles to Work

BY JOHN A. HONEGGER

OCCASIONALLY a mechanical part is so designed that it becomes necessary to mill or drill an interior surface which is so located

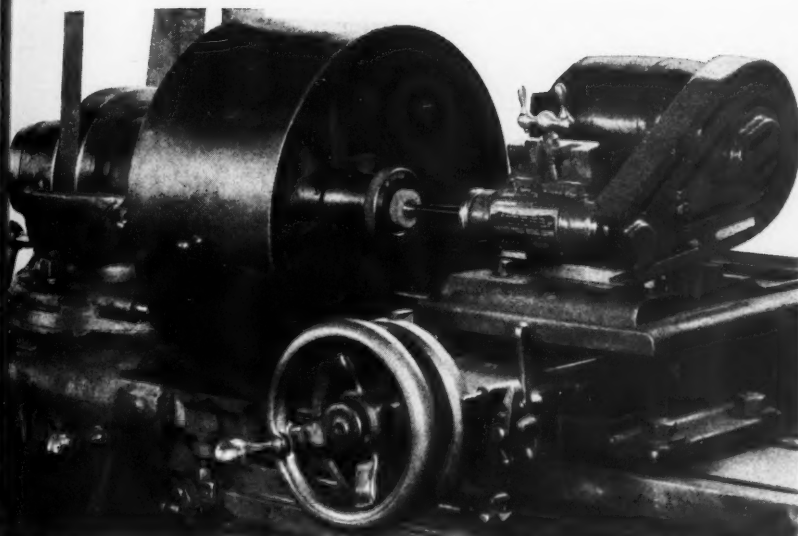


Drawing illustrating design of interchangeable mechanism for guiding a slide in a rectangular path.

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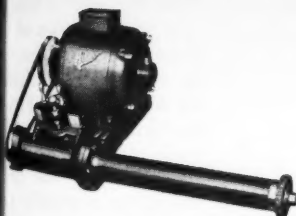
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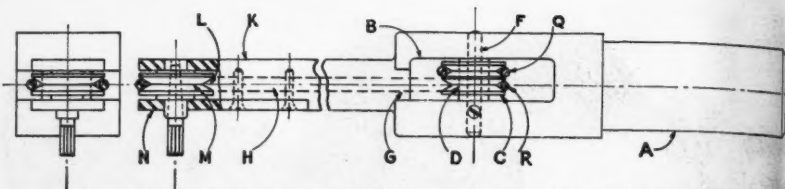


Fig. 1—Design of tool for machining at right angles to an interior surface.

that means must be found to operate a tool at right angles to the aperture through which the tool is inserted. Such a condition was presented recently when the writer undertook to machine a number of parts for a special machine. The design called for a small recess rather far down in the bore, and the bore was too small in diameter to make the job an

of the holder to take the belt H.

At the outer end of the shank A, a recess L was milled just wide enough to take the single pulley M. As will be noted, the pulley M was made integral with its axle, so as to be as compact as possible and to provide a positive drive for the taper shank drill or mill. The axle was, of course, provided with a taper hole to take the shank of the tool. The plate N was made a separate section to facilitate assembly.

A general idea of the appearance of the tool in operation is afforded by the drawing Fig. 2. In order to drive the tool, a round belt was passed over the drum which is normally provided for the grinding attachment of the lathe, the belt also being passed around one of the grooves in the pulley C. A round belt

from the other groove in pulley C to the pulley M completed the drive. To eliminate "rapping", the belts were spliced and cemented. The tool was as efficient as it was simple.

The Lathe Serves as a Milling Machine

BY MICHAEL AXLER

THE drawing illustrates a new method of machining a curved surface. We had several hundreds

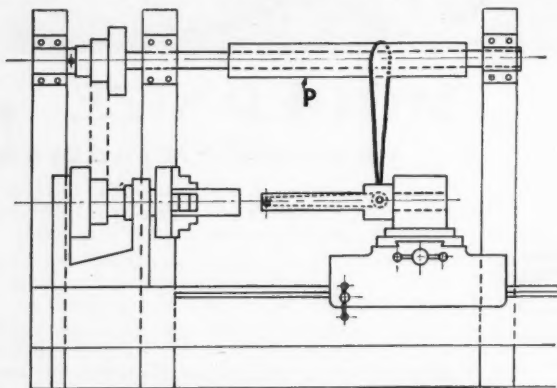


Fig. 2—General arrangement of the tool in operation

easy one.

To perform the recessing operation, the writer designed the attachment shown in Fig. 1. A Rivett bench lathe having been selected for the job, the tool was designed with a shank A of the proper size to fit into the tool-post. A rectangular slot B was milled into the holder to accommodate the tandem pulley C, the pulley being bushed with bronze bushing so that it would revolve smoothly on the axle F. A slot G was milled the length

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swing-links, indicated at A in the illustration, that had to be milled so as to provide an extra $1\frac{1}{4}$ in. clearance between the bosses for certain parts

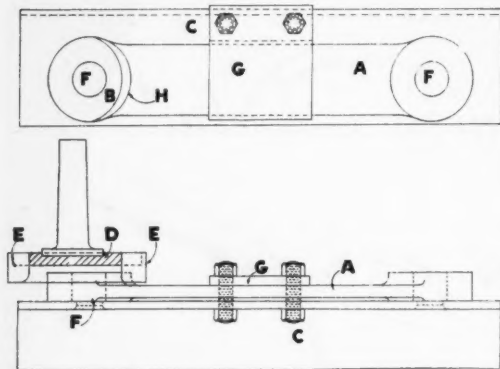


Illustration of method used to increase clearance between bosses of a swing-link.

of the machines in which they were to be used. This meant that $\frac{5}{8}$ in. of stock must be removed from the inner side of each boss, as shown at H, but it was necessary that the stock be machined off on a curve, both so as to avoid weakening the link more than necessary and so as to maintain as good an appearance as possible.

The job was tried on the shaper, but it took much too long and was altogether unsatisfactory. The only milling machine in the shop could not be spared, so we were put to the necessity of making use of an old lathe that was standing idle. The only way this could be done was by inserting the milling cutter into the headstock spindle and holding the work on the carriage.

For a fixture we made use of a section of heavy angle iron that was long enough to provide support for the entire length of the link as shown at C. We bolted the angle iron to the carriage of the lathe and put in the two pins F for locating pins. Two

bolts and the clamp G were used to hold the work in position.

The cutter was a serrated blade facing cutter which we had on hand and which was large enough to provide the correct radius for the job. The blades, E, were rounded off on the inner corners to provide a fillet as shown. The $\frac{3}{8}$ -in. depth of cut was obtained by using the longitudinal feed of the lathe, and the correct dimension between bosses was obtained by using the cross-feed of the carriage.

Although the tool left the bosses elliptical, rather than circular, it produced a good job. Both the tooling and the operation costs were small.

Unusual Design of Forming Die with Automatic Feed Attachment

BY ALBAN J. CARLSON

AN interesting and—I believe—unusual design of a forming die, together with an automatic feed at-

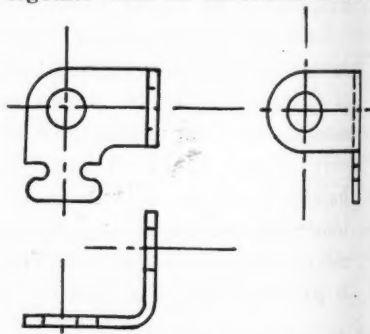


Fig. 1—Drawing, double size, of part blanked and formed in dies described in this article.

tachment for a blanking die as shown in the drawings herewith. The blank shown double actual size in the draw-

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METHOD**

MITCO pin splice tools permit "grinding down" to a new edge far beyond the point where conventional tools would have to be scrapped. This is because perfect adjustment, positive clamping, and adequate support are independent of tool length. Thus tool life is lengthened and production costs sharply reduced.

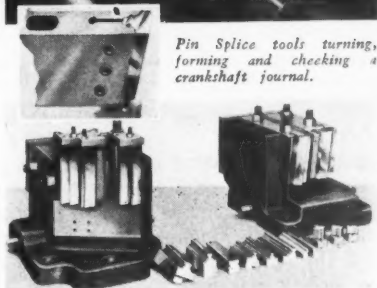
The pin splice mounting method combines the advantages of both the dovetail and dowel methods, yet retains none of their disadvantages. As tools are ground down, "used" stock is replaced with filler blocks. Breakage is ended by eliminating the sharp corners of conventional dovetail tools.

Grinding back the rake always restores correct cutter form. Thus it is possible to combine normally separate cutters in a single tool. On the other hand the design of MITCO pin splice tools permits their use in even the simplest form of lathe tool holders.

A folder describing and illustrating these tools in more detail is available for mailing on request. Ask for a copy.



Pin Splice tools turning, forming and checking a crankshaft journal.



(Middle Left) Simple forming tool showing clamping, filler block and support. (Above) Set-up for rough and finish turning, checking and forming, also filler blocks and individual tools.

MICHIGAN TOOL COMPANY • DETROIT, MICHIGAN

ing Fig. 1, was previously made with hand-fed blanking and forming dies of the ordinary type. The maximum production obtainable was 500 pieces per

and dies. As a result, the tools illustrated in the drawings were developed resulting in a production of 7,200 pieces per hour with one operator running two presses.

The feed attachment shown in Fig. 2 consists of the plunger block A, plunger B, roller D, spring F, pawl E, fastened to plunger and cam C which is attached to the punch holder. The dimension X is the multiple length of the blank. The slot K should really be made longer if there is a possibility that the attachment is to be used for other dies, but the new cam must be made to conform to the length of the blank. It was found necessary when operating the press at high speeds to fasten a spring (not shown) to the stripper and bearing on the pawl to prevent the pawl from jumping away from the stock.

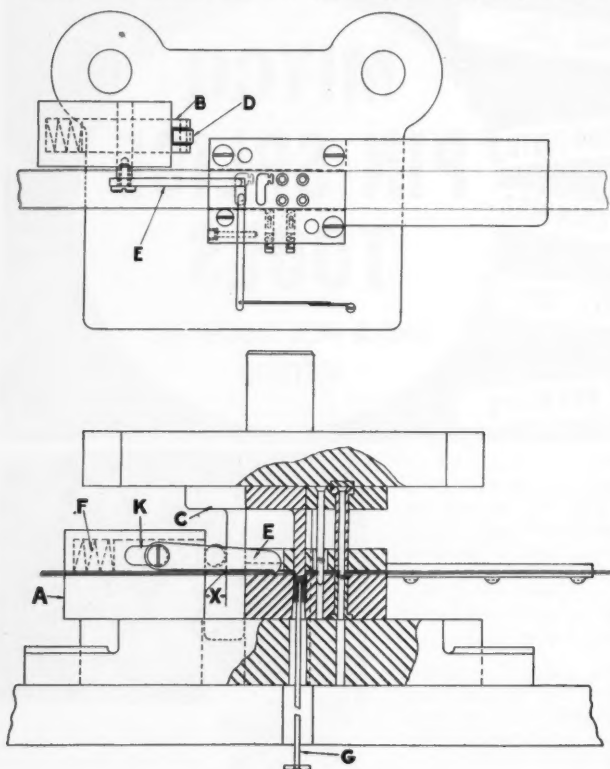


Fig. 2—Design of blanking die and feed attachment.

hour. The forming operation was particularly slow partly because the operator had to feed the work to the forming die with pinchers, both on account of the small size of the blank and as a safety measure.

Production schedules were increased from 4,000 to 32,000 per day, and it became evident that if tools of the same type were to be used, a small army of operators would be necessary, to say nothing of additional presses

and keep the blanks in order for feeding into the forming die, two wires were riveted to the plate G, Fig. 3, then they were curved to suit the press and anchored to the floor in such a way that, should the operator forget to remove them when filled with blanks, the wires would be merely pushed away from the die and no damage would result.

The forming die, illustrated in Fig. 3, is built upon the same principle as

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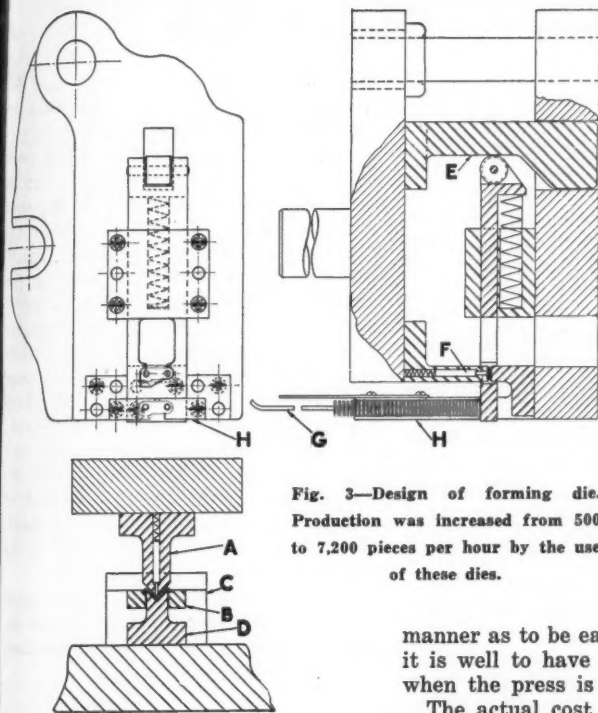


Fig. 3—Design of forming die. Production was increased from 500 to 7,200 pieces per hour by the use of these dies.

the ram descends. In so doing, it also removes the blank formed on the previous stroke.

Care must be taken not to exclude the oil-pin shown at F. If this oil-pin is not provided for the blanks will stick to the punch A, resulting in a double blank and serious damage to the die.

The wires indicated at G, Fig. 3, should be hooked to the press in such a

manner as to be easily removable, and it is well to have the magazine filled when the press is started.

The actual cost of the dies was as follows: blanking die, including automatic feeding attachment, \$132.00; forming die, \$110.00. The die could be duplicated today for much less than this figure. In conclusion I might add that production was later increased to 52,000 per day, and that the dies actually paid for themselves in six days of production.

the feed attachment. As the press ram ascends, at the completion of an operation-cycle, the cam E pushes the blank carrier B so that the bottom blank in the stack in the magazine will slip into a recess made for it in the top of the carrier and thus will be carried back to forming position as

PUTNAM HI-SPEED END MILL CATALOG No. 2. The line of precision tools for modern production made by the Putnam Tool Co., 2981 Charlevoix Ave., Detroit, Mich., is described and illustrated in a 22-page booklet which is now being issued by this firm. Included in the Putnam "HiSpeed" line are extra long double four-flute end mills, two-flute double end mills, two-flute double end slotting or router bits, single end mills, ball end mills, long end mills with hollow ground spiral flutes, straight shank

jig borer end mills, end mill holders, and other tools. Copy free upon request.

DUMORE No. 44 TOOLMAKER—a small lathe grinder that, through revolutionary new engineering principles, can handle may jobs heretofore restricted to the larger, more costly tools—is described in a folder that is being distributed by The Dumore Company, Dept. 185, Racine, Wis. Copy free upon request.

Over the Editor's Desk

Leadership?

SPIRITUAL leaders are faced with a magnificent opportunity today; the need for real leadership is greater than it has ever been, which makes it all the more regrettable when those who have assumed such leadership bring down discredit upon their heads by making utterly unfounded assertions concerning the relation of modern industrial methods to the economic welfare of the nation.

Some thirteen clergymen of various faiths, gathered together in New York recently, took occasion to issue a statement that "invention, mass production, machinery, and scientific management are reducing the need for workers" and that "the machine is taking the place of men and women." Such an assumption is born of superficial thinking and sheer ignorance.

In commenting upon the above statements, Mr. Norman D. MacLeod, President of the National Machine Tool Builders' Association, quotes some interesting figures. Mr. MacLeod says "Studies made by the Brookings Institute, by the National Industrial Conference Board, and others establish the fact that, from 1870 to 1930—a period of unprecedented mechanization during which the population of the country almost tripled—the percentage of persons gainfully employed increased from 32.4 per cent to 39.8 per cent. Would this substantiate the contention that machines are encroaching on men?"

"These studies have shown further that in the most highly mechanized industries employment levels were substantially higher even during the depths of the depression. Thus while in 1932 production had dropped 47 per cent from 1929, employment in

the manufacturing industries had declined only 39 per cent. In June of this year employment stood at 76 per cent of the 1929 average, while production was only 71 per cent of 1929.

"Every statistical study of the subject has come inevitably to the conclusion that mechanization of industry has produced an increase in the variety of goods and services available to the community, an improvement in their quality, and an expansion of their volume far greater than the growth in population. Working hours have also been reduced, without reducing the total of employment opportunities. The results are the substance of the high standard of living in the United States—a standard which is without parallel in the human record.

"We believe that those who speak irresponsibly about 'technological unemployment' should consult the facts before they speak."

Do You Want One?

SO many requests were received for extra copies and back numbers of the issues containing C. L. Szalanczy's series of articles "Punch Press Operations and Tools" that the editions carrying these articles have long since been exhausted. However, the requests continue to come in and so we are considering printing the series in the form of a book to be approximately the size of this magazine and to sell at probably one dollar.

Before we go ahead with the job, however, we must know about how many copies should be printed. If you are interested in obtaining one of the books, **make your reservation now**, so that we can get the books off the press and into your hands as quickly as possible.

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*For the
Tool Room*

for Requirements

A NEW universal tool and cutter grinder—the No. 2—
which swings 12" and takes 28" between centers.
Its universal work head takes 3½" per foot and B & S
tapers; mounts a face plate, three jaw chuck or face
chuck; swivels and can be set at any angle in both ver-
tical and horizontal planes; has separate graduations
for setting clearance angles. Cylindrical, internal and
surface operations are all performed with equal ease.
And perhaps the outstanding feature of all is the ability
to traverse the table by power—hydraulically.

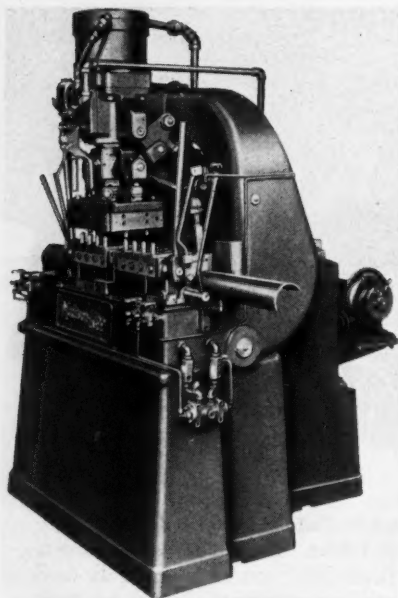
M-350

DEERS

New Shop Equipment

Madison-Kipp Model 7 Vertical Die Casting Machine

The Madison-Kipp Corporation, Madison, Wis., has augmented its line of die casting machines by the addition of the Model 7 Vertical Machine shown in the illustration. This machine is a special-



Madison-Kipp Model 7 Vertical Die Casting Machine

purpose production unit intended for pressure die casting lead or zinc alloy parts requiring inserts of other metals or materials in multiple cavity dies.

The Model 7 Vertical Die Casting Machine is fully pneumatic in operation. The metal pressure chamber or gooseneck from which the metal is supplied to the die cavity is air operated and the ram for opening and closing the dies is also air operated, as is the traveling table. One or two men may operate the machine from valves located at both

sides of the machine. Ample safety devices are provided to insure only the proper cycle sequence when two men operate the machine.

As shown in the illustration, the traveling table is equipped with two sets of multiple cavity die halves and the ram is equipped with one mating upper die half. While castings are being made in the left hand die, the right hand die is open so that an operator is free to place a full set of inserts handily and quickly. The ram is raised, the table indexed so that the right hand die comes into the casting position under the ram, and the left hand die is moved out into the clear at the extreme left of the machine. While a new casting shot is being made, castings in the left hand die are ejected and new inserts placed after which the above cycle is reversed.

The upper half of the machine automatically rocks back into contact with the metal pressure chamber or gooseneck at each downward stroke of the ram. On the ram up-stroke, this machine assembly rocks forward and clear of the gooseneck. Only when the machine is locked in casting position can castings be shot. Cables or rod inserts may extend from the dies and out as far as necessary in front of the machine. The weight of the Model 7 Vertical Machine is 5800 lbs. The length is 62 in., width 60 in., and height 74 in. The metal pot capacity for lead is 675 lbs. and the gooseneck or metal pressure chamber capacity for lead is 13 pounds.

Packer Polishing and Buffing Machine

The illustration shows a polishing and buffing machine built by the Packer Machine Company, Meriden, Conn., to meet a demand for a polishing and buffing unit which would be capable of producing a definite per hour production requirement. The machine is equipped with 14 wheel heads, 10 of which are equipped with 10 h.p. motors and 4 with 7½ h.p. motors. Power is transmitted to the wheel spindles by multi-V belts. Each wheel head is equipped with a Packer Automatic Composition Feeding Device. Work is carried to the wheels by 38 work-holding fixtures, mounted on



**THERE IS A
DIFFERENCE**

It shows up

IN

CUTTING SPEED

• Not only cutting speed, but *safe* cutting speed plays a large part in your small tool satisfaction. The ability of Morse Tools to maintain high cutting speeds safely and economically is one of the reasons why production and shop men everywhere say "there is a difference."

What assures this difference in Morse Tools? Years of experience in the making of precision cutting tools put one extra value behind the Morse trade mark. Another results from carefully controlled hardening, another from exceptional accuracy in grinding. Step-by-step inspection adds its part.

Next time you hear someone say that all leading metal-removing tools are alike, tell him to try Morse Tools. Tell him it will be worth his while in lower costs and better work to prove to himself "there is a difference."

A conveniently located Morse Distributor assures prompt service.

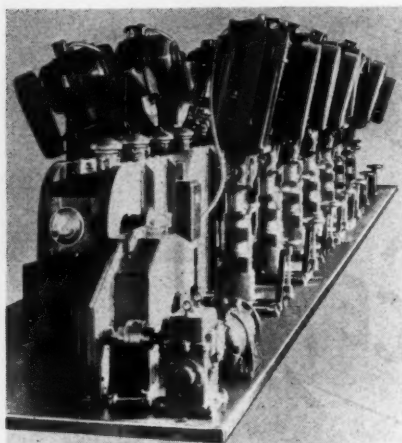
MORSE

**TWIST DRILL & MACHINE COMPANY
NEW BEDFORD . . . MASS., U. S. A.**

New York Store: 130 Lafayette St. • Chicago Store: 570 W. Randolph St.



a conveyor chain. The chain is operated intermittently, the intermittent movement being controlled by an indexing unit which is driven by a 3 h.p. New



Packer Polishing and Buffing Machine

Departure "Transitorq" Variable Speed Unit.

Each motor on the machine has its own individual control and the machine is equipped with anti-friction bearings throughout. The center distance between work-holding fixtures is 24 in. The ball bearing spindles to which the work holding fixtures are fastened can be rotated at variable speeds, also driven by a 1 h.p. New Departure "Transitorq" Variable Speed Unit. The work spindles do not rotate at the loading stations; thus the work is easily loaded and unloaded.

The machine is 42 ft. long and 7 ft. wide and the weight of the complete machine is 16 tons.

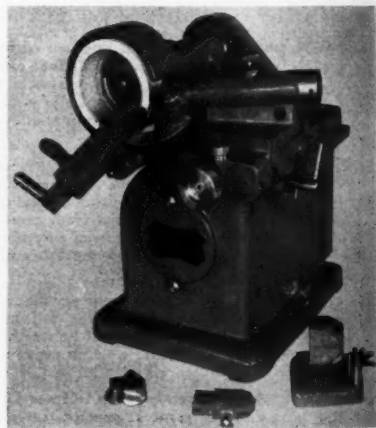
Oliver No. 21 Drill Grinder

A drill grinder especially designed for simply and accurately grinding small drills has been placed on the market by the Oliver Instrument Company, Adrian, Mich. This grinder—known as the Oliver No. 21—makes use of a jig in order to insure that the drill will be inserted into the machine and held in the correct position for correct grinding. The drill can be placed into the jig at

a point some distance from the machine if necessary in order to obtain extra good light and then the jig is transferred to the machine and the drill ground without further adjustment.

The machine consists primarily of a base which contains the motor, and supports a grinding wheel bearing and carriage. The carriage has a bearing which supports a graduated arc and holding fixture. The jig is essentially a pair of jaws into which the drill can be clamped. It is entirely independent of the machine and a gage is provided for properly setting the drill in the jig. After the drill has been properly set, it is placed in the holding fixture and one lip of the drill is ground, then the jig is reversed and the second lip is ground. Both lips will be ground to the same length.

Drills can be ground with various point angles from 80 deg. to 180 deg. and shoulder drills may be ground on the shoulder as well as on the point. The rated capacity of the machine is from 3/32 to 1/2-in. drills. However, by using a collet holder, drills from 3/32 in. down to the No. 57 may also be ground. The machine may be arranged to grind left hand drills or the thick-web type of oil hole drills used in crankshaft drilling. Power is supplied



Oliver No. 21 Drill Grinder

by a 1/4 h.p. motor and is transmitted by a V-belt to the ball bearing wheel spindle.

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UNIVERSAL JOINT SOCKET WRENCHES



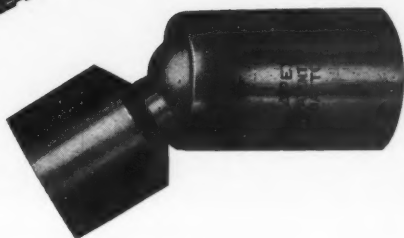
For tightening nuts and screws in hard-to-get-at places are real time and money savers on assembly operations.

Shanks are furnished for any size or type of electrical or air tool—also furnished with shanks to fit Yankee Screw Drivers for small assembly work. Sockets are furnished in any length, diameter and broaching to suit to job.

Apex Universal Joint. Socket Wrenches will reduce your assembly costs.

Are time tested—simple in construction and exceptionally strong. No projecting ears, pins, screws or sharp corners. They cannot over travel their working angle of 35°. Diameters $\frac{1}{2}$ " to 4".

UNIVERSAL JOINTS



Ends can be bored for connection to your shafts, or may be machined with square holes or the ends may be turned to form shoulders. We can machine them to meet your requirements.

Used in hundreds of plants for all kinds of angular drives and controls. Also used on aircraft for fuel cock controls, stabilizer controls, starter cranks and retractable landing gear.

Also manufacturers of Safety Friction and Positive Drive Tapping Chucks, Vertical Float Tapping Chucks and Tap Collets. Full Floating and Semi Floating Tool Holders, Self-Releasing Stud Setters, Plain Socket Wrenches, Screw Drivers, Apex S. & H. Adjustable Machine and Shell Reamers and Expansion Reamers.

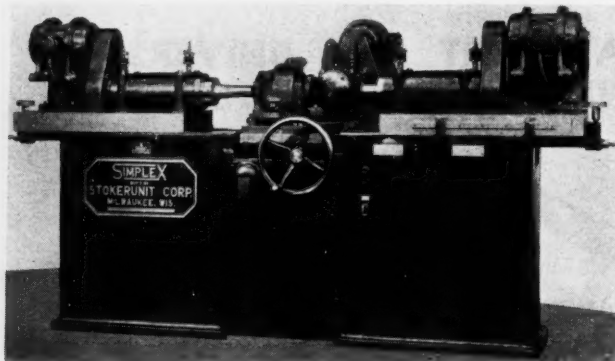
Write For Catalog No. 8

THE APEX MACHINE & TOOL CO.

THIRD AND MADISON STREETS, DAYTON, OHIO

Simplex Precision Unit Boring Machine

A precision boring machine which is designed for the precision boring of several holes on different faces of a workpiece simultaneously has been brought out by the Stokerunit Corporation, 5323 W. Rogers St., Milwaukee, Wis. In this



Simplex Precision Unit Boring Machine

machine the elements of a standard type precision boring machine are rearranged to operate all at one time without losing accuracy or flexibility of setup.

The machine has a heavy cast bed with either two or three sets of V and flat ways, each carrying a platen to support and guide the spindles. One or more spindles of suitable size can be mounted on each platen. A feed mechanism driven by an individual motor drives the feed through pick-off gears to provide changes as required. For manual cycle the platens are brought to the work by the hand wheel and at the start of the cut a limit switch starts the

spindles and engages the feed. A second switch stops the feed at the end of the cut and the platens are returned to starting position by means of the hand wheel.

In the automatic cycle, the electrical control operates a traverse motor which advances the platens to the feeding position and also returns them after the

cut, thus establishing full automatic control. Each platen is provided with individual adjustment to the work but normally all feed at the same rate. Spindle speeds can be arranged to suit requirements.

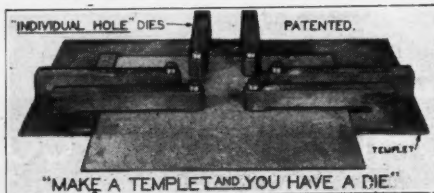
The maximum feed length range of the machine shown is 12 in. The No. 1 or No. 1L Machine is built to use six spindles and the No. 3 is built for three spindles, to bore holes from $\frac{3}{8}$ -in. to 8-in. diameter. The spindle speeds range from 300 to 5000 r.p.m. The height from the floor to table is 32 in. and the overall length of the machine is 76 in. Net weight, 4800 pounds.

Van Norman No. 10 Automatic High Speed Piston Grinder

An extremely fast, heavy duty machine for turning and grinding pistons, to be known as the No. 101, has been announced by Van Norman Machine Tool Company, Springfield, Mass. The No. 101 finishes pistons of both the

WALES UNIVERSAL PERFORATING DIES

Why spend money for perforating dies when you can shift these "INDIVIDUAL HOLE" dies around to punch almost any arrangement of holes in flat parts?



MAKE A TEMPLAT AND YOU HAVE A DIE

You can be in production the same day you first see the print of a part.

Punches up to $\frac{3}{8}$ " dia. in 14 ga. steel.

Write for detailed booklet.

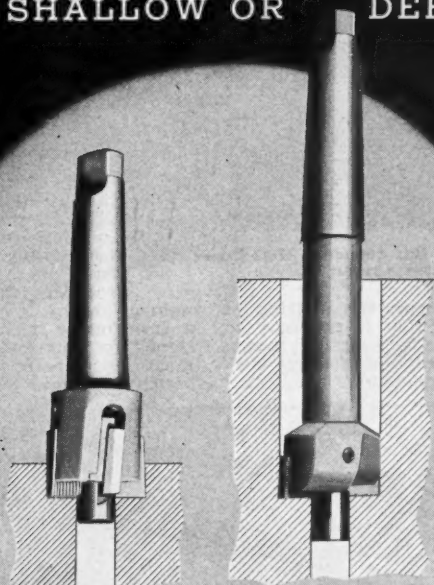
The Strippit Corporation

1559 Niagara St., Buffalo, N. Y.

INGERSOLL ZEE LOCK

Counterbores

SHALLOW OR DEEP



For spotfacing or shallow boring operations where depth is less than one half diameter.

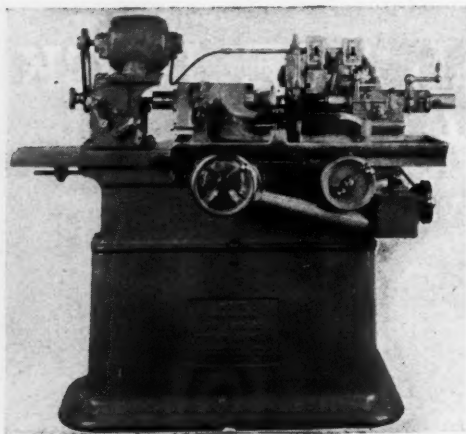
For deep boring operations, enlarging deep cored or drilled holes.

Adjustable Ingersoll Zee Lock Cutter Blades are fitted into a forged and heat treated alloy steel body, which is relieved by generous chip clearance. Pilot is interlocked and driven by adjustable inserted blades.

Send data of your counterboring problems for free Ingersoll Tool Engineering.

Write for new Ingersoll Cutter Catalog, an information hand-book on the design and use of all types of inserted blade tools.

THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U. S. A.



Van Norman No. 101 Automatic High Speed
Piston Grinder

straight and cam type, the shifting of one lever being all that is necessary to convert the machine from straight to cam grinding. The machine is of heavy construction, built throughout to machine

tool standards. All ways are hand scraped and bearings are of the anti-friction type, designed for easy and accurate take-up for wear.

According to the manufacturer the high speed of the machine comes not only from increased spindle speeds and wheel feeds but also from the machine's extreme simplicity and ease of operation. It is stated that an operator can set up the machine more rapidly and handle pistons with less loss of time for chucking. A number of speeds are available at the wheel and work heads.

Glascoek Metal-Master Welder

An electric spot welder especially designed to make available a machine of the highest type for work within its capacity has been placed on the market by Glascock Bros. Mfg. Co., Muncie, Ind. The welder, shown in the illustration, has a transformer which was especially designed for this machine by the General Electric Company, providing equipment which is unique in that either of two



A large plant reports increased machine production of 9% as result of regularly applying Research Belt Dressing. You, too, can turn out more per hour and cut your unit cost by treating belts regularly with Research. Ask your distributor for it or write direct to the Home of Research.

PRICES

Quart	\$1.00
1/2 Gal.	1.50
Gallon	2.75
5 Gal.	12.50

GRATON & KNIGHT COMPANY, WORCESTER, MASS.

RESEARCH BELT DRESSING

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Modern Die Making Equipment

Continuous filing — Internal band sawing without welding. Internal filing jobs as well as internal sawing jobs set up in $\frac{1}{2}$ minute. Smooth clean cutting with speed and accuracy.

Write for further information.

\$95.00

Without
Motor and
Switch

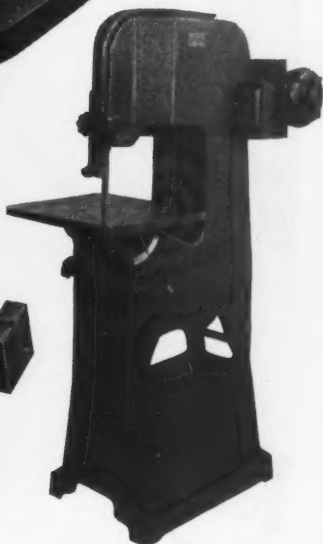


**BENCH FILING
MACHINE**

U. S. Patent
No. 1949742
Other Patents Pending



**OPEN END
BAND SAW**

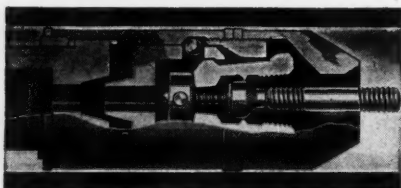


FLOOR MODEL

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High Speed Stud Setting The New Way

The Titan Stud Setter is a new self-opening type for driving stud bolts . . . it is full automatic in loading and releasing. It is a power driven unit adaptable to all types of drill presses and air or electric tools. Positive in driving and automatic in releasing, the studs may be set to any predetermined height desired and without straining or mutilating the threads.



The Titan Automatic Self-Opening Stud Setter provides most outstanding stud setting advantages. It will seat practically any type of stud and is adaptable to very successfully setting studs of extremely short lengths. It provides for increased

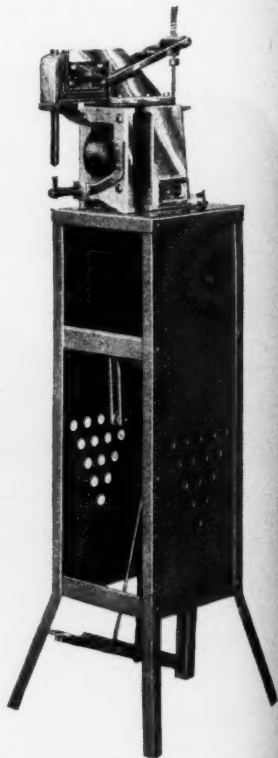
production due to capacity, speed range and service . . . plus the added economy which its safety features assure by automatic operation. Write for new bulletin.



TITAN TOOL CO.
Fairview • Penn.

heats is available by the simple expedient of changing the fuse plug mounting within the welder. At the same time this arrangement affords protection to the general circuit.

The frame of the welder is entirely of cast aluminum and the welder coppers are held in cast aluminum posts with heat radiating fins. The welding copper tips are of a special alloy, following the practice of production spot weld-



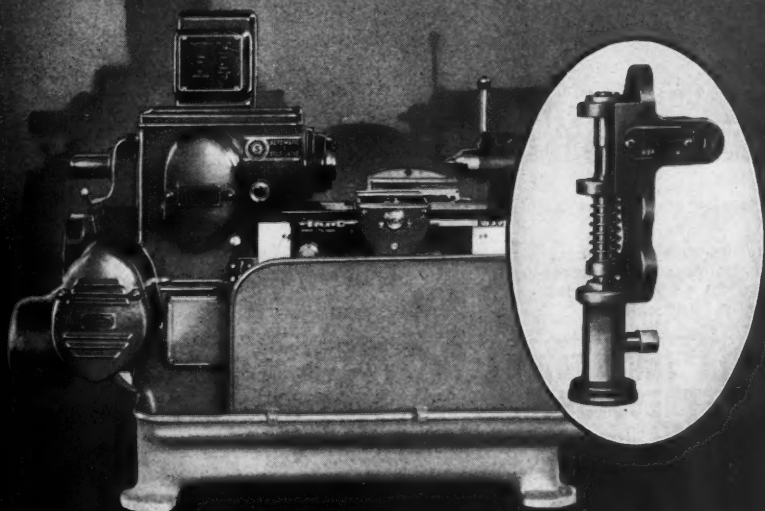
Glascock Metal-Master Welder

ers, and the top copper is actuated by an absolutely vertical line by means of a unique compound leverage principle. An outstanding feature of the welder is the switch, which carries ample copper contact surfaces with a control so delicate that a paper clip can be tacked, at one extreme, or two pieces of $\frac{1}{4}$ -in. wire can absolutely be fused together flush or melted one into the other, at the other extreme.

The welder will securely fuse 16 U.S.

LONGER LIFE

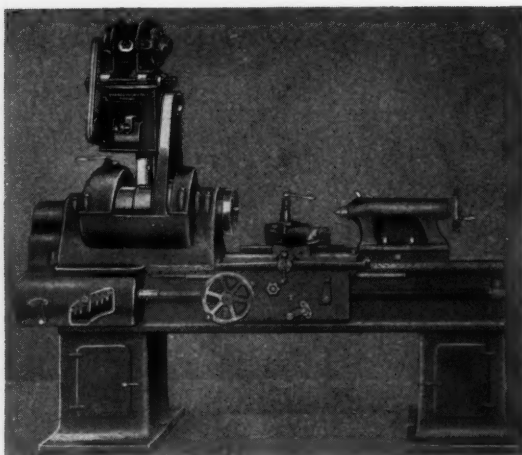
For Machine Tools



It pays to buy machines equipped with Bijur Automatic Lubricators. No bearings overlooked, less wear, less maintenance, more accuracy, longer life.

BIJUR LUBRICATING CORPORATION, LONG ISLAND CITY, N. Y.

Automatic **BIJUR** *Lubricators*



Steege Motor Drive Applied to an Engine Lathe

gauge metals and lighter, and by changing the fuse plug from heavy to light, 24 to 30 gauge material can be welded without burning.

for application of the drive. Eccentric action counteracts the weight when raising or lowering the cone pulleys for changing belts, and the belt tension

Steege Universal Motor Drive

W. L. Steege Machine Co., 18 S. Clinton St., Chicago, Ill., has placed on the market a line of motor drives intended for application to belt driven machine tools. These drives make it possible to provide an individual drive for each machine, the drive being directly applied to the machine and thus being self-contained. The drives are made in sizes for 3 h.p. to 5 horse power.

In each case the drive is mounted on a column which is especially designed for application to the type of machine with which it is to be used. Neither the machine nor its setup is affected, four bolt holes only being necessary, in the base or column of the machine. Eccentric action counteracts the weight when raising or lowering the cone pulleys for changing belts, and the belt tension

SMALL INVESTMENT IN ATLAS DRILL PRESS DOUBLES PRODUCTION

The Reynolds Electric Company, prominent electrical product manufacturers of Chicago, find Atlas Drill Press equipment efficient and economical. They are tapping between eighteen hundred and two thousand 9-36 threads per hour in steel with an Atlas Model 70. The press is running full time.

DOES 5 HOUR JOB IN 2 HOURS

Its purchase represented a very large saving, the price being only a fraction of other equipment considered. On this same Atlas, Reynolds is now doing in two hours a tap job that formerly required five hours on a regular tapping outfit.

Atlas Drill Presses are standing up under this and many other similar jobs and maintaining their accuracy. They will do the same in your plant. Made in four sizes, bench and floor models. Prices range from \$14.45 to \$39.45. See them at your jobbers or write direct for new 1936 catalog.

ATLAS PRESS COMPANY

1846 N. Pitcher St.

Kalamazoo, Mich.

Complete display at Atlas Sales Co., 35 E. Wacker Dr., Chicago.



Universal
Drive

Machine
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placed on the
of motor
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FOR 1936 RUNNING IN OIL

Also new friction Material especial-
developed for sensitiveness as
well as long life, entirely elimina-
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New ball bearing
pilot guarantee-
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alignment.

THE NEW BIAX TAPPERS

All ball bearing equipped—
forward and reverse fric-
tion—double reverse speed.

In sizes from No.
2 to 3/4"



*Write for
detailed
catalog or
demonstration.*

The CHARLES L. JARVIS Company
GILDERSLEEVE, CONN.



This Ward Leonard Rectifier, without moving parts, offers a most economical means of providing direct current from alternating current supply. It costs but a fraction of the price of a motor-generator set and operates with far less

electrical loss and no mechanical loss. It requires no maintenance.



Magnetic Chuck Rectifiers are simple in operation and easy to install.

This is the device you have been looking for to operate your magnetic chucks. Send for full particulars.



Send for descriptive bulletin

Bulletin 8651 describes the Magnetic Chuck Rectifier and points the way to save you time and money.

WARD LEONARD

RELAYS · RESISTORS · RHEOSTATS

WARD LEONARD ELECTRIC CO.
39 South St., Mount Vernon, N. Y.

Please send me your bulletins, Nos.

Name _____

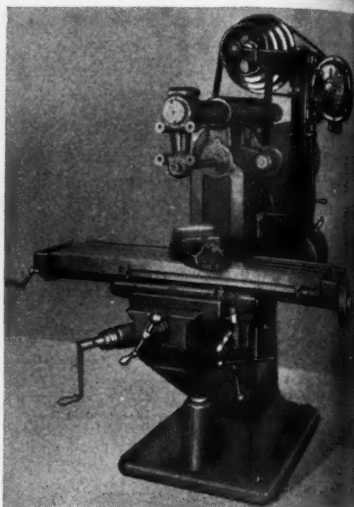
Company _____

Street _____

City and State _____

adjustment is simple with finger control.

Steege Motor Drives are available for lathes from 8-in. to 30-in. swing, requiring from $\frac{3}{4}$ to 5 h.p. motors. Milling



Miller Equipped with Steege Motor Drive

machine drives are available in from $\frac{3}{4}$ to 5 h.p. size and shaper drives are available for from 12-in. to 32-in. machines, requiring from 1 to 3 h.p.

Taft-Peirce Superpower Precision Duplex Base Magnetic Chuck

A new tilting and swiveling magnetic chuck, known as the Superpower Precision Duplex Base, designed for the precision grinding of compound angles, has been announced by The Taft-Peirce Manufacturing Company, Woonsocket, R. I. Originally designed for grinding formed tools, the device offers advantages in time saving and increased accuracy in the grinding of compound angles of any nature and also in producing work requiring the grinding of simple angles.

The powerful magnetic unit of this chuck swivels to 90 deg. on either side of horizontal. It can also be tilted along its axis to any angle from 0 deg. to 14 deg. Two simple adjustments take the place of the long and complicated setups commonly required for



THE CUDDY-GARDNER CO.
SUCCEEDING THE
TAFT MACHINE CO.
ESTABLISHED 1870
MANUFACTURERS OF

TAFT CARPET
SEWING MACHINES

SPECIAL
MACHINERY

DISPLAY RACKS
PROVIDENCE, RHODE ISLAND, U.S.A.

June 20, 1935

ATTENTION C. O. HEDNER

The Yale & Towne Mfg. Co.
Philadelphia, Pa.

Gentlemen;

Upon receipt of your favor of the 18th we looked up the record of the ONE TON YALE & TOWNE HOIST, for which we received some repair parts the other day, and find that the purchase was made on May 2, 1916.

Therefore, this hoist has been in constant use for nineteen years and the parts just furnished are the only ones with the exception of one other ratchet and pawl that were replaced about ten years ago, after some of our employees had overloaded the hoist.

We believe it would be almost impossible to make extravagant claims for the durability of this device.

Very truly yours,

The Cuddy-Gardner Company

H.T. Leander

TREASURER



and that's
Service
plus!

.... 19 years in service at
a cost of less than $\frac{1}{4}$ of a
cent a day for maintenance.

Yale Electric Hoists speed up production, insure safety and promote economies in materials handling operations—send the coupon.

The Yale & Towne Mfg. Co., Philadelphia Division
4832 Tacony St., Philadelphia, Pa.

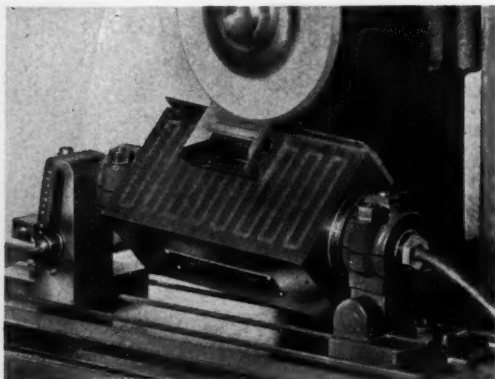
Gentlemen:

Kindly send me the illustrated folder containing detailed information with regard to YALE Electric Hoists.

Name of Firm.....

Individual..... Title.....

Address



**Taft-Peirce Superpower Precision Duplex Base
Magnetic Chuck**

grinding compound angles. Accurately-graduated scales permit the making of exact angular settings and means are provided for clamping the chuck rigidly in place at whatever setting has been made.

The electrical construction of this chuck follows the familiar Taft-Peirce

Superpower all-steel principle. The magnetic unit is accurately ground on top, bottom, and sides and the entire device is built to gage standards of precision and finish.

Improvements in Moore Jig Borer

Marburg Brothers, Inc., 80 West St., New York, N. Y., distributors of the Moore Jig Borer, announce some interesting improvements in this machine. The column width has been increased together with the base width and length, increasing the length and width of bearings for slide ways and making the machine about 300 lbs. heavier than it was previously. The machine is equipped with built-in lighting, starting switch and wiring, a wiring casting being provided on the back of the column where both power and light can conveniently be hooked up.

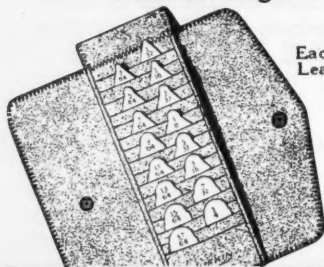
The spindle nose has been improved so that it is now possible to use end reamers in this machine. Automatic power feed has been provided, control

most practical in actual work

LUFKIN

Radius Gages

the handiest and safest
Radius Gages



Each set in
Leatherette
case.



Each gage is a separate unit for convenient and accurate application to the work.

Each gage carries the corresponding external and internal forms, the practical combination.

Send for Precision Tool Catalog No. 7

THE LUFKIN RULE CO.

Saginaw, Mich., U. S. A.

106-110 Lafayette St., New York

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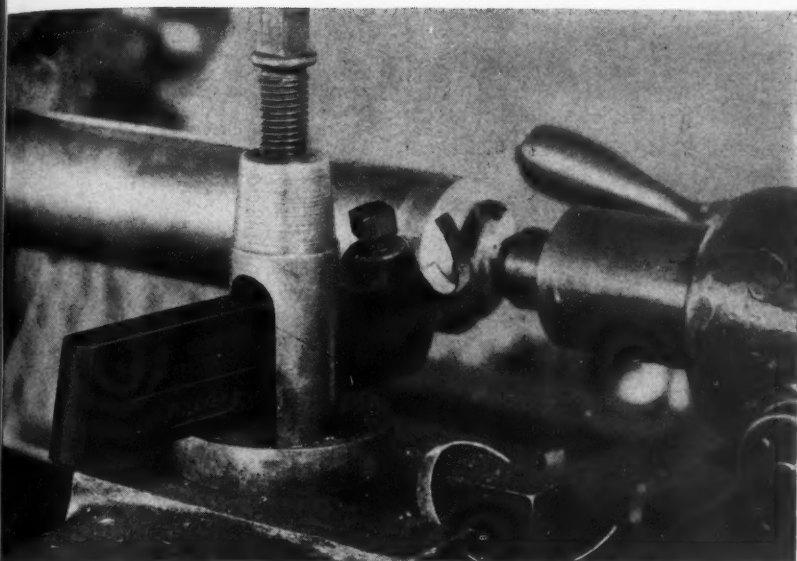
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BETTER TOOL HOLDERS

Williams' "Agrippa" Tool Holders have earned their reputation as the "Holders that hold" solely upon their superior performance. Accurate broaching of the cutter seat and careful hardening all the way through provides a chatter proof grip even after years of service with short bits. The hardened seat will not become marred or recessed—the commonest cause of cutter breakage.

There is an "Agrippa" Tool Holder for every regular operation of Lathe, Planer and Shaper. Ask for literature describing their unique advantages.

Cutting-off and Side Tool
Holder. Furnished
R. H. Straight.
R. H. and L. H.
Offset.

BUY FROM YOUR
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Right Hand Offset
Turning-Tool Holder.
Also Straight and
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WILLIAMS
SUPERIOR DROP-FORGED TOOLS
"AGRIPPA"
TOOL HOLDERS
"THE HOLDERS THAT HOLD"



Boring Tool Holder.
Either sleeve or straight bar.

Threading
Tool Holder
with formed cutter.

J. H. WILLIAMS & CO., — 75 Spring St., NEW YORK
Headquarters for: Drop-Forged Wrenches (Carbon and Alloy), Detachable
Socket Wrenches, "C" Clamps, Lathe Dogs, Tool Holders, Eye Bolts,
Hoist Hooks, Thumb Nuts and Screws, Chain Pipe Tongs and Vises, etc.

WESTERN WAREHOUSE, SALES OFFICE, CHICAGO. — WORKS, BUFFALO, N. Y.

Rotor Screw Drivers

and

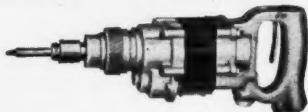
Nut Setters

**Will speed up
your production job**

Powerful but light weight tools for driving wood or metal screws and for nut running.



Size E-O, illustrated with an adjustable friction clutch and screw driver bit. A nut socket can be used instead of the bit. By means of this clutch the screws or nuts can be set uniform.



Size E-1C, illustrated with a positive drive dog clutch which allows the spindle to idle until forward pressure is applied and releases when forward pressure is relieved.

Also made in larger sizes.

Send for Catalogue

The Rotor Air Tool Co.

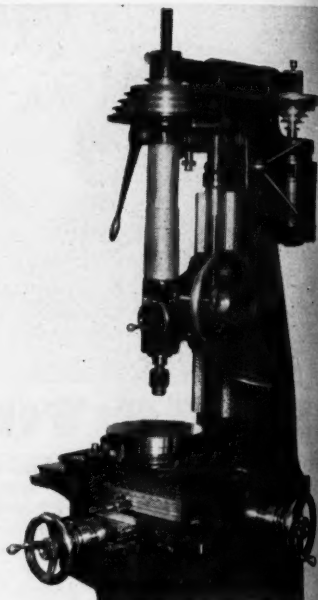
5600 Carnegie Ave., Cleveland, Ohio

European Representative

GASTON E. MARBAIX, Ltd.

Vincent House, London.

being provided through a small shift lever located just under the hand wheel. Shifting this lever will cause the spindle to feed either up or down or remain neutral. The feed is obtained through a double worm reduction which provides an extremely steady and smooth feed. A friction drive is provided as a safety



Spindle of Moore Jig Borer with Improvements

measure, however, making it impossible for the machine to be damaged by allowing the feed to run up or down too far. All running parts are mounted in ball bearings.

B & S Rotary Geared Pump with Helical Gears

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently announced the inclusion in its line of pumps, of a new series known as No. 1S, No. 2S and No. 3S Rotary Geared Pumps with helical gears. The helical gears are smooth and quiet. They permit higher speeds than pumps with spur gears and make the pump available for a direct drive from ordinary motor speeds. They also have renewable bronze bearings which provide for easy replacement. Intended primarily

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BARBER - COLMAN

Always Accurate and Dependable



MILLING CUTTERS,
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SPECIAL TOOLS

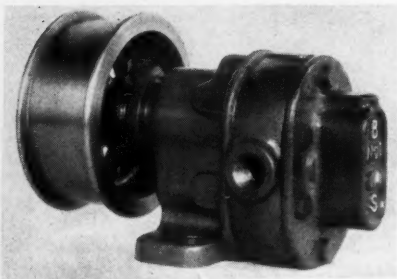


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FOR CATALOG J

BARBER-COLMAN COMPANY

General Offices and Plant ROCKFORD, ILLINOIS, U. S. A.

rily for use with comparatively clean liquids, these pumps are particularly suited for pumping clean oil, oil emulsion, soda solution, etc. They are especially advantageous for cooling installations where quietness is essential at



B. & S. Rotary Geared Pump with Helical Gears

motor speeds and where precautions are taken to keep chips from the pump; also for light hydraulic operations the helical gears insure a steady flow of oil without pulsations.

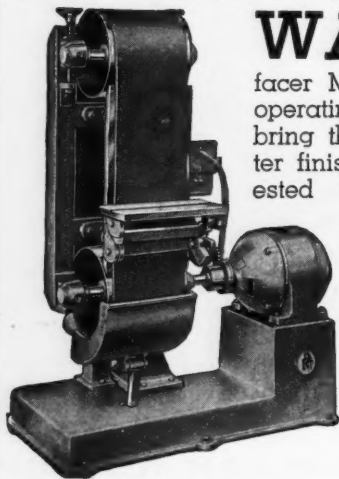
The pumps run in either direction;

discharge is on side of pump toward which top of pulley rotates. Pumps will raise oil on suction side a distance of 25 to 35 ft. with tight piping and at speeds above 1,000 r.p.m. In pumping water grease cups can be applied to pump bearings, and lengthen the life of pump. Pumps can be furnished, when required, with a relief valve which acts as an emergency safety valve.

Link-Belt Single-Reduction Worm Gear Reducer

Announcement is made by Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia, Pa., that it is now in production on a new line of cut-tooth Worm Gear Speed Reducers of simple, compact, accessible construction, offering great flexibility of driving arrangement. The new reducers are available in a wide range of ratios and capacities, with single or double reduction, and in horizontal and vertical types; all provided with precision tapered roller bearings and automatic lubrication within dust-proof gray iron housings.

The output shaft with its chilled phosphor bronze worm wheel can be located above or below the worm shaft, which is made of a low-carbon alloy.



WANTED: The advantages of Peerless Surfacers are known to all companies operating them in their shops. We want to bring these advantages (lower costs and better finishing) to all companies who are interested in more economical manufacturing methods.

Peerless Surfacers give a high quality, straight line finish to metal, rubber, fibre composition, wood, etc. In many instances a rapid cut on a Peerless may be substituted for an expensive milling or planer operation. Vertical or horizontal machines available in 4" to 20" sizes.

*Tell us your problems
and write for literature.*

PRODUCTION MACHINE CO.

Greenfield

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FIBRO FORGED

TRADE MARK



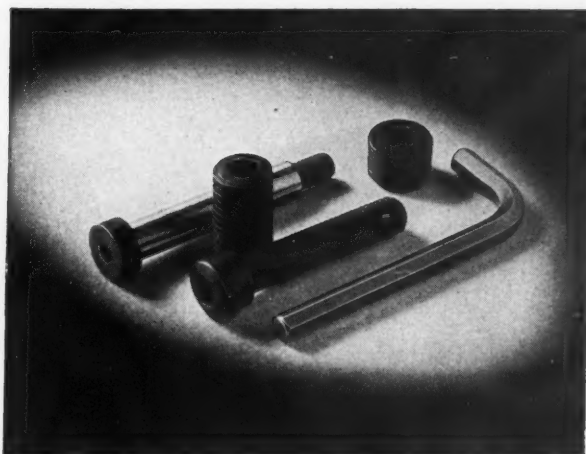
Socket Walls are reinforced. True Hex. Socket. Continuous Fibres from end to end.



The Accuracy of Socket formation and unusual depth.



"File Hard" Wrench counterpart of the FIBRO FORGED Screw.



SOCKET SCREWS for MODERN MACHINES and TOOLS

Have every part of your newly designed machine, even the Socket Screws, made in the most modern manner and with "brute strength" for long life.

FIBRO FORGED Screws, the results of an entirely new process, having features heretofore desired but not found. Continuous Fibres, from end to end. That means more strength. . . . Reinforced Socket Walls. . . . That's long life. . . . Appearance that makes even a Socket Screw a thing of beauty. . . .

Put FIBRO FORGED Screws to the Test—Ask any Holo-Krome Distributor or write the factory direct, for enough to make your test. They'll be sent Free of Charge.

The swing is to Holo-Krome and FIBRO FORGED Screws.

FIBRO FORGED
TRADE MARK



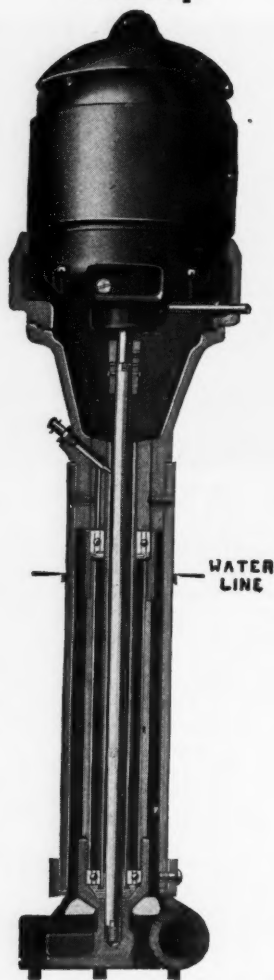
SCREWS

HOLO-KROME SCREW CORP.
BRISTOL, CONN.

Tensile and Tortion—Make your TEST-FIBRO FORGED Screws will sell themselves to you. Say how many and give sizes. Write Dept. "H".

HOLO-KROME

Brownie Coolant Pump



CAPACITIES 10-100 G. P. M.

Write for Bulletin No. 10

Tomkins-Johnson Co.

620 N. Mechanic St., Jackson, Michigan

steel forging, carburized and heat-treated after the worm threads have been cut thereon. A feature of the double-reduction reducer is the unitized attachment of primary reduction unit to the side of final-reduction housing. Conforming with the recently recommended practice of the American Gear Manufacturers Association, the name plate of each Link-Belt worm reducer is stamped in



Link-Belt Single-Reduction Worm Gear Reducer

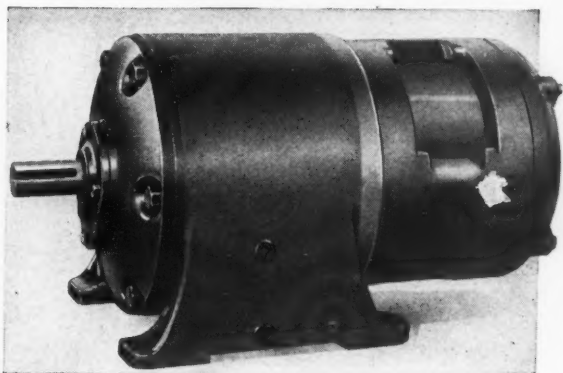
indicate the ratio, input and output r.p.m., the input horse power or output torque capacity, and the service factor used in determining the rating for which the unit has been sold.

A 40-page illustrated catalog No. 1588 has been prepared, giving dimensions, service factors, A.G.M.A. horse power ratings, and engineering data for selection of the right reducer unit. This book will be sent gratis to any reader upon request.

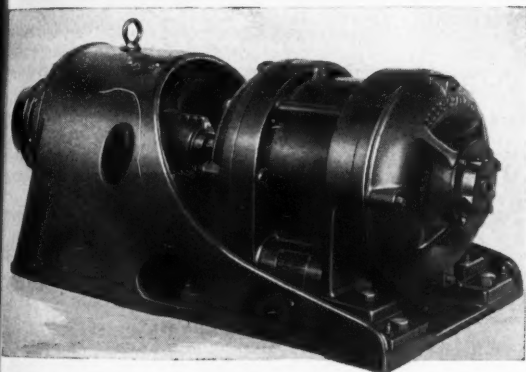
Hisey-Wolf Portable Motor Driven Worm Thread Grinder

The machine shown in the illustration is a Portable Motor Driven Worm Thread Grinder which has been placed on the market by The Hisey-Wolf Machine Co., 2747 Colerain Ave., Cincinnati, Ohio. Figure 1 is a side view of the machine showing the grinding wheel, wheel guard

*Integral
Type*



GEARMOTORS



*All Motor
Type*

Nearly all motor applications require some means of speed reduction and the Allis-Chalmers Gearmotor supplies this demand in one unit.

Allis-Chalmers Gearmotors are efficient and compact providing speeds from 6 to 1165 rpm. These speeds are obtained with the inherent advantages of high speed motors.

Mounting may be either horizontal or vertical.

Units are available in both integral and all motor types.

ALLIS-CHALMERS

— Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin, U. S. A. —

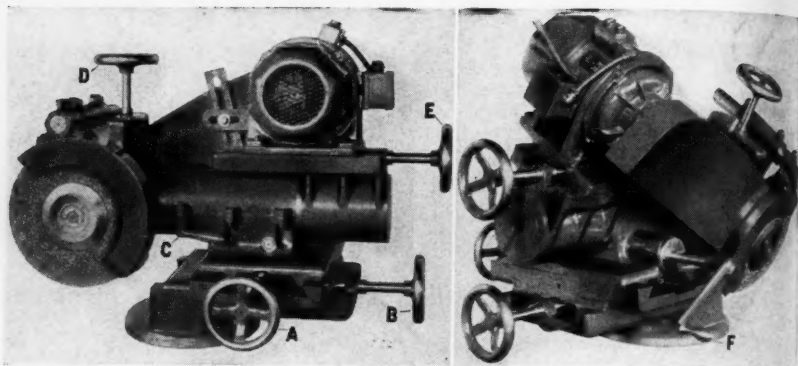


Fig. 1. (Left)—Hisey Portable Motor Driven Worm Thread Grinder. Fig. 2. (Right)—View showing angular adjustment for grinding head.

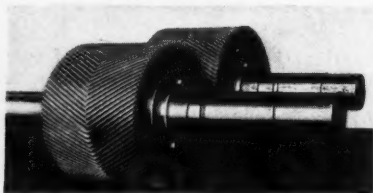
hand wheel A for cross feed adjustment, clamp lever C for locking the spindle after the grinding wheel has been adjusted to the desired angle, hand wheel D for raising or lowering the grinding spindle, and hand wheel E for adjusting the motor. The crank wheel F, shown in Fig. 2, controls a worm and

worm wheel angular adjustment for the complete grinding head, either to left or right as shown.

The grinder is equipped with super-precision bearings, large, heat treated spindles, and motors that have been dynamically balanced in the laboratory. Power is transmitted to the wheel spine-

HIGH VELOCITY GEARING

Requires
EXTREME PRECISION
in MANUFACTURE



These Farrel-Sykes continuous tooth herringbone gears for the main reversing drive of a high speed blooming mill function perfectly at a peripheral speed of 4300 feet per minute.

In the production of Farrel-Sykes Gears for high speed service special study is given to all the factors involved in order to produce gears that will operate with maximum efficiency, smoothness and quietness.

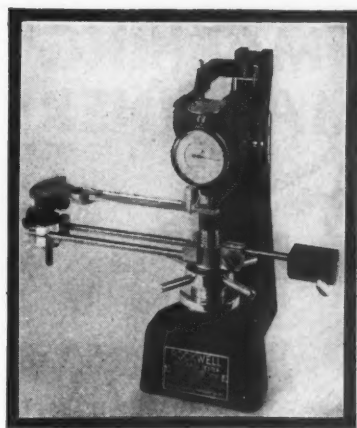
The development of the equipment and the technique for generating high precision gears is pursued intensively. The use of harder, stronger and better materials receives constant attention. Standards of accuracy are progressively improved.

These factors, combined with the inherent advantages of the Sykes Gear, result in extra load-carrying capacity, quiet operation and the ability to give long, trouble-free service under the severest conditions.

FARREL-BIRMINGHAM COMPANY, INC.

381 Vulcan St., Buffalo, N. Y.

The Newest "ROCKWELL" HARDNESS TESTER with its Vari - Rest



THIS Vari-Rest No. 10 may be clamped to the elevating screw wherever desired. The support members slide along the two stainless steel rods. The dark looking tube of the support member may be raised and lowered by an adjustment nut. Observe the two collars on the tube. They slide lengthwise of the tube under the friction control of steel balls backed by springs. They also may be rotated around the tube and one of them is eccentric.

and a convenience because, being mounted right on the elevating screw, the whole system goes up and down together as the capstan hand wheel is turned. This Vari-Rest No. 10 will fit any old or new "ROCKWELL" Hardness Tester having a 3" or greater vertical capacity.

How old is your "ROCKWELL" Catalog? The 10th edition is now available.

WILSON

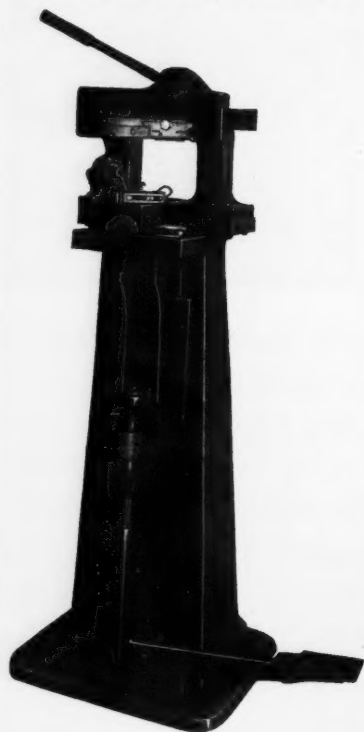
MECHANICAL INSTRUMENT CO., INC.

Concord Ave. & East 143rd St.

New York, N. Y.

If you have moderate size pieces of peculiar shape or even light rods or tubing to test you would find this Vari-Rest a help

MARKING MACHINERY



HI-DUTY MARKING MACHINES are built in standard designs for general marking, as well as special designs to perform specific jobs of marking. They are built in manual as well as power drives. Continuous service to metal fabricators in the country since 1895 has given us a world of experience, which may be of value to you. Send in prints or sample parts with lettering, locations, hourly production and lettering changes required. We will be glad to make recommendations without obligation to you.

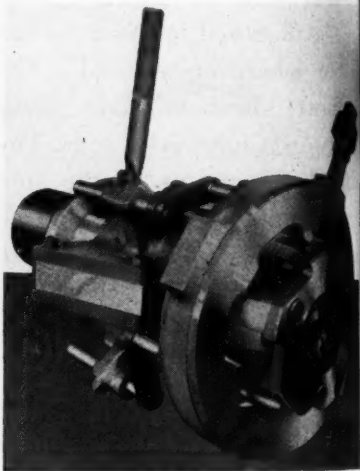
GEO. T. SCHMIDT, Inc.
1806 BELLE PLAINE AVE.
CHICAGO, ILL.

dle by means of a V-belt and the manufacturer states that the correct speed is always available. Any special speed that might be desired can be furnished.

A universal wheel dressing attachment can be furnished for retruing bevel and straight face wheels when mounted on either end of the grinding spindle. It is provided with a screw feed adjustment and graduated so that it can accurately be set at any angle. The diamond holder can be mounted on either side of the wheel and is provided with a graduated feed. The Hisey Portable Worm Thread Grinder is made in three sizes—1, 3 and 5 h.p. for any voltage, alternating or direct current.

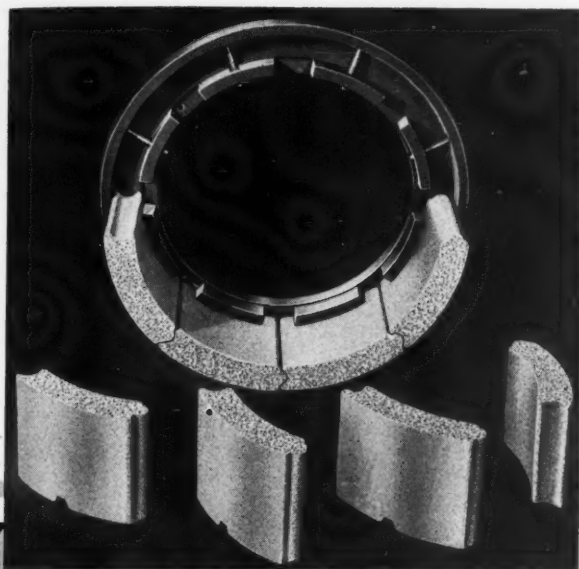
Landis Oil Type Trip Ring for Collapsible Taps

When tapping any threads, particularly long threads of large diameters in steel, it is very essential to maintain



Landis Oil Type Trip Ring for Collapsible Taps

an ample supply of lubrication to dissipate the heat and wash away the chips. To insure a sufficient supply of lubricant for its line of collapsible taps the Landis Machine Company of Wayneboro, Pa., has placed on the market an oiling type of trip ring to replace the conventional type of ring usually employed on a collapsible tap. The accompanying illustration shows one of these



THE NEW STERLING SEGMENTAL WHEEL AND CHUCK

INTRODUCED but a few months ago this new STERLING segmental wheel and chuck is TODAY a recognized SUCCESS.

DESIGNED for light weight, for easy and quick installation of STERLING segments and for low cost efficiency grinding it has quickly earned its way into many plants where surface grinding is an important operation. You too are invited to try this unit about which operators are so enthused.

Patent Applied For

For BLANCHARD—PRATT & WHITNEY—DIAMOND—CAPITOL Grinders

THE STERLING GRINDING WHEEL COMPANY

Abrasive Division of The Cleveland Quarries Co.

Factory and Office: TIFFIN, OHIO CHICAGO: 133 N. Wacker Drive DETROIT: 101-107 W. Warren Ave.

STERLING ABRASIVES

rings applied to a 6-in. Landis Style LM Receding Chaser Collapsible Tap.

The ring consists of a hollow housing with steel plates mounted on the front and the back, thus forming a reservoir for holding the lubricant. On the smaller sizes of rings the housing is made of cast iron and in order to lessen the weight the housing for the larger rings is made of aluminum. The front ring which contacts the work to effect the receding and collapsing action of the tap is made of steel and case carburized to resist wear. Holes are placed diagonally in the housing through which a

stream of oil is forcibly directed upon each chaser throughout the entire length of the cut, thus insuring ample lubrication at the point where it is needed.

A supply pipe with union connection is provided for attaching the supply hose. The housing of the trip ring remains stationary while the front and back plates will turn with the tap if the tap must revolve for tapping the thread. These rings are available for use with Landis Style LM Receding Chaser and Style LT Collapsible Tap 6-in. size and larger.

GRANT RIVETERS



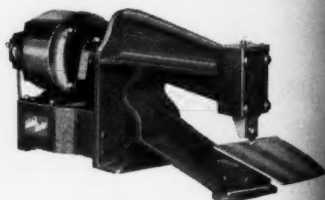
● Pioneers in the riveting field. Head rivets from smallest to $\frac{5}{8}$ " diameter, either by noiseless spinning or vibrating hammer method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature—and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
96 Silliman Avenue Bridgeport, Conn.

Glascok Universal Jig Shear

The illustration shows the Universal Jig Shear now being marketed by Glascok Bros. Mfg. Co., Muncie, Ind. The shear has ample strength and capacity for cutting No. 18 U.S.S. gauge mill

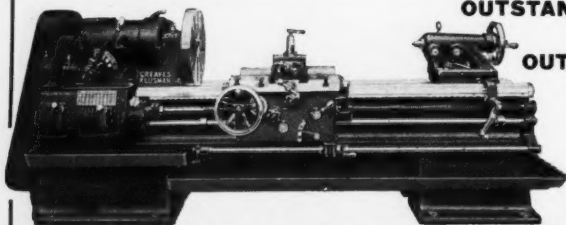


Glascok Jig Shear

steel or its equivalent. The shear is capable of straight slitting 12 to 15 ft. per minute.

The tool is built on a heavy cast aluminum frame, the total weight of the machine being approximately 80 lbs. Power is supplied through a $\frac{1}{4}$ -h.p. G. motor and direct flexible coupling with switch mounting integral with the motor. The frame has a 9-in. throat. The cutting stroke is $\frac{1}{2}$ in. and the speed is 1720 r.p.m.

The upper and lower cutters are



THE GREAVES-KLUSMAN TOOL CO., Cincinnati, O.

OUTSTANDING PERFORMANCE provided by

OUTSTANDING FEATURES

G. K. Single Lever Control Lathes will give you the production efficiency you want on your lathe work. Write for catalog describing complete details.

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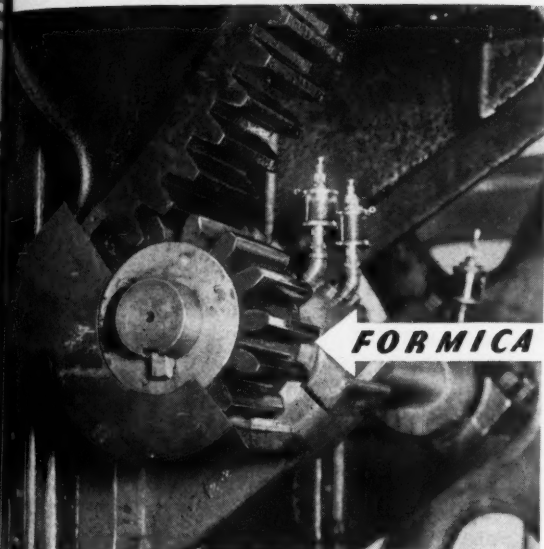
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FORMICA

HEAVY as well as light drives may be silenced and improved by the insertion of an elastic member if large Formica gears are used for the purpose.

Metal to metal contacts sometimes result in a grind and screech that is very unpleasant and which exhausts the nerves of the workmen and results in less efficiency and poorer work.

More and more manufacturers are using Formica gears to provide an important sales point for their sales departments.

More and more maintenance engineers are using Formica because it keeps things running smoothly and sweetly.

The gear cutters named can give you prompt service on one or many gears.

THE FORMICA INSULATION CO. • 4640 Spring Grove Ave., Cincinnati, O.

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NON-METALLIC
GEARS

FORMICA GEAR CUTTERS

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- The Adams Company
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- The Ferguson Gear Co.
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- Hartford Special Mchny.
Co., Hartford, Conn.
- Beatty Machine Works
Keokuk, Ia.
- The Generating Gear Co.
Milwaukee, Wis.
- Badger State Gear Co.
Milwaukee, Wis.
- Precision Machine Co.
Milwaukee, Wis.
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Minneapolis, Minn.
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Havana, Cuba
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- The Pittsburgh Machine &
Supply Co., Pittsburgh, Pa.
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Pittsburgh, Pa.
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ALL INDUSTRY DEPENDS ON

Mac-its

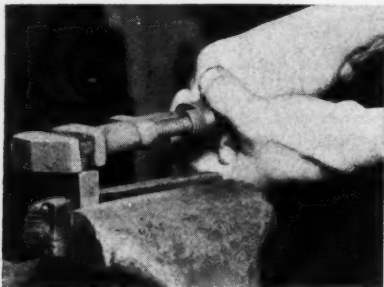
Pronounced
"MACK-ITS"

... FOR TOUGHNESS

The Mac-it test consists of trying to twist off the head of a Mac-it Quality Square Head Set Screw. Ask the Mac-it salesman or your nearest Mac-it distributor to demonstrate it. Or better still, write for the Mac-it test set, free on request.

Place the head of the screw in a good, strong vise, apply a man-size wrench and p-u-l-l. You will succeed only in rupturing the test-block.

Make the Mac-it test and you too will agree that Mac-its are TOUGH.



—or do it this way!

THE STRONG-CARLISLE and HAMMOND CO.

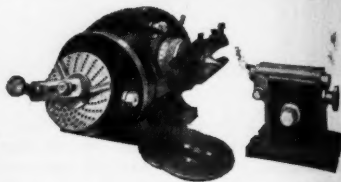
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$\frac{3}{4}$ -in. high speed, self-hardening reversible blades, cutting on either end. Adjustment is provided by shortening the blades as they are reground. The lower cutter holder is cam mounted, and can be instantly lowered or raised by means of a small lever mounted underneath the table. When lowered, the holder is below the surface of the table, permitting of quick withdrawals from dead end cuts or of interior cutting without preliminary punched holes. The advantage of this tool is its great speed, the ease with which a scribed line can be followed and the extremely long wearing ability of the cutters in comparison with other tools. Cutters can be replaced at small cost.

The drive shaft is equipped with bronze bearings and the eccentric head is a special alloy bronze bearing alloy operating in cast ways. The tool is of sturdy and durable construction, capable of doing a vast amount of continuous production work.

10½-In. L-W Universal Dividing Head

A 10½-In. Universal Dividing Head illustrated herewith, has been placed on the market by L-W Chuck Company, 20 N. St. Clair St., Toledo, Ohio. Of swivel construction and graduated to 18 deg., the head can be tilted above or



10½-In. L-W Universal Dividing Head

below the vertical and perpendicular lines. The graduated spindle and index plunger provide for quick indexing and a locking device is provided, consisting of a split bushing which can be clamped on the tapered spindle. An adjustable take-up collar is provided for end thrust on the spindle.

The head is built with an oversize worm and worm wheel which are lapped in and which can be adjusted closely eliminating back lash in the spindle. The index plates are ground, and the centers are hardened and ground. A vertical adjustment is provided for the tailstock center. Regular equipment includes $\frac{3}{4}$ -in. table slot tongues and

KNURLED

UNBRAKO

Socket Head Cap Screw



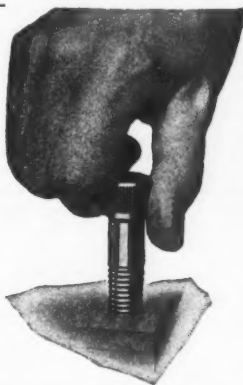
Every mechanic, when driving screws, will invariably use his fingers as much as possible, because they are much handier than any wrench and save time.

With the Knurled "Unbrako" he can drive much faster, as his fingers actually become geared to the Knurled Head so they can't slip.

Smooth Head Screws, hard to get hold of are much slower to drive.

The Knurled "Unbrako" is of exactly the same high quality as the smooth head "Unbrako", —

**BUT COSTS
NO MORE.**



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**Order by Name—Specify:
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U. S. & Foreign Pats. Pending
Fingers become geared to
the knurled "Unbrako"
and therefore can't slip

Hercules Lathe Collet



three index plates giving all divisions up to 380 together with a chart explaining the operation of the head.

Hercules Lathe Collet

The illustration shows a lathe collet, known as the "Hercules", which is now being marketed by the Modern Collet & Machine Co., 401 Sallotte St., Ecorse, Mich. This collet is said to be so constructed that all the locking power a man can possibly apply is directed entirely on the jaws, thus assuring an exceedingly tight grip. The collet will accommodate a bar as large as the hole in the lathe spindle, and if it is to be used entirely for short pieces, an even larger size can be used. Each set of jaws can be used in an emergency on stock from $\frac{1}{16}$ over to $\frac{1}{16}$ under the nor-

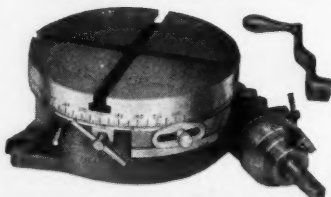
mal diameter, which will prove to be a time saver in many instances.

The collet requires no extra parts or machining in order to apply it; it is simply screwed into the spindle nose in place of the regular chuck. The design is such that there are no threads to wear out and no continual springing action; thus the parts are said to be practically indestructible. The collet is available in all sizes for all types of lathes and screw machines.

Inspectron Model LR2 Semi-Automatic Gage

The illustration shows the Inspectron Model LR2 Semi-Automatic Gage which has been placed on the market by the Electronic Inspection Laboratories, 94 Prospect Ave., Cleveland, Ohio. The gage is intended for manual operation and the model shown will take any size material up to and including 1 in. In checking round pieces, the piece is inserted into the gage mouth against the back stop and between the anvil and the spindle. If the diameter of the piece is within the limits set, the first one of the three lights on the top of the gage is lighted; if the piece is under size, none of the lights are lighted and if the piece is oversize, the third light indicates this fact. These lights are

STEVENS ROTARY TABLES



7 1/2 in. Rotary Table for Small Miller Tables.

Table graduated for single degree reading and worm shaft collar for readings in single minutes. Worm can be disengaged for turning table by hand.

Vertical lock pin provided for divisions of 2, 3, 4, 6, 8, 12 and 24. Other sizes 12" and 18" diameters.

Send for circular.

JOHN B. STEVENS INC.

306 HUDSON ST., NEW YORK, N. Y.

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that Costs Industry Nothing



Countless opportunities for economies and improvements . . . without added expense or radical changes . . . are being uncovered by design engineers and shop executives with the aid of a PARKER-KALON ASSEMBLY ENGINEER

Throughout the metal working industries it is conceded that one of the most important modern aids to production speed and economy is Parker-Kalon Hardened Self-tapping Screws. So much simpler to use than other fastening devices . . . and affording greater holding power in most cases . . . these unique screws solve many assembly problems. Hundreds of metal and molded products are being made better and more economically as a result. Numberless jobs are done in less time, with less labor and trouble.

There are many concerns, though, who are missing the advantages this outstanding assembly modernization could give them. And, thousands who now employ it to a degree could benefit further by applying it to other assemblies still being made by more difficult and costly methods. So this invitation to use Parker-Kalon's Assembly Engineering Service is important to every manufacturer.

Through this Service any plant may obtain the co-operation of an Engineer who by reason of years of practical experience and a broad knowledge of assembly methods is a specialist in his field. He sells nothing. His sole function is to work with interested engineers and shop executives in searching-out all opportunities for cost reduction, design simplification and product improvement that might be attained through Hardened Self-tapping Screws. In seven out of ten cases such searches lead to worthwhile benefits, without investment or radical changes of any kind.

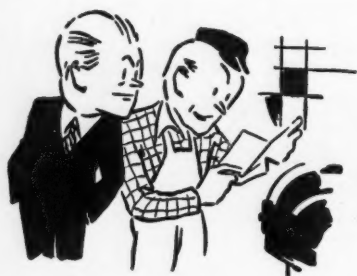
What Opportunities exist in your Assembly Work?

Certainly it will pay to find out whether you are making the fullest use of this assembly modernization that has worked production miracles on hundreds of products from artificial limbs to airplanes. Your request will bring a Parker-Kalon Assembly Engineer to you, without cost or obligation.

PARKER-KALON CORPORATION, DEP. M., 198 VARICK STREET, NEW YORK

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HEX HEAD A Type for Every Kind of Assembly



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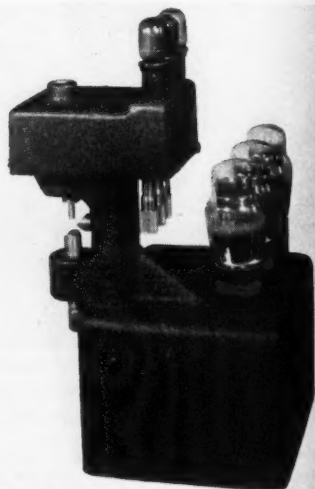


KOEBEL

DIAMOND TOOLS

operated by Inspectron vacuum tube rays.

Actual experience with the gage indicates that it has a sensitivity of 0.00001 in. and can readily be set within 0.00001 in. Space is also provided for a dial indicator reading 0.0001 in. which is helpful in setting up the gage. The set-up is accomplished by inserting standard and adjusting three micrometer heads in the rear of the gage, either by using the dial indicator or the micrometers themselves, there being a



Inspectron Model LR2 Semi-Automatic Gage

to 1 amplification in the gage itself. The 0.001 in. reading on the micrometer can be taken as a 0.0001 in. in the setting and the 0.00001 in. estimated.

The gage is provided with an adjustable regulator for spindle pressure and with an adjustable anvil and spindle with the major adjustments made so that they can be locked in by the supervising inspector. Special attention is called to the spindle of this model, the spindle being $\frac{1}{8}$ -in. in diameter and the measuring similar to the standard pocket micrometer. The spindle pressure can be increased to a very high point without injuring the face of the ground material on the parts that are being checked. It is also to be noted that there is no long cylindrical arm holding the anvil and spindle. These are closely coupled through a hardened anvil and spindle or tungsten carbide tipped spin-

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Grinding — Polishing — Buffing —
Reaming — Wire Brushing — Drilling
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and many other operations.



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Many Attachments.

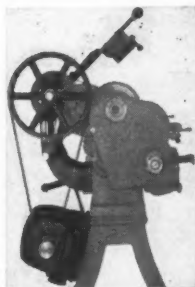
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NO SCALE—NO OXIDIZATION—NO PITTING For Better Heat Treating INTERVAL

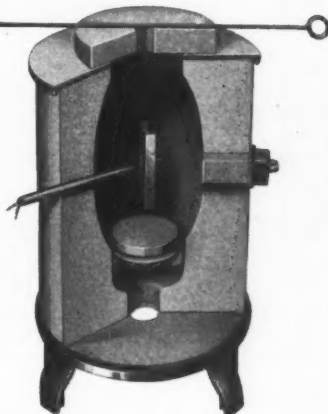
H EAT straight carbon steel, Hi-Carbon, Hi-Chrome, and High-Speed steels from minimum to maximum temperatures without loss in size, or danger of pitting, or oxidization.

Pyrometer fire end in close proximity to work.

High speed heat in less time and at less expense regardless of fuel used.

Opening inside of furnace permits heat treating the ends of long parts or tools. Can be converted quickly into a lead, cyanide, or salt bath furnace accommodating 6 x 12" pot.

GUARANTEE: INTERVALS are sold on 30 days trial. Return them at our expense if they do not make good.



Send for descriptive folder.

BENNETT INSURED STEEL TREATING CO.

130-132 SOUTH ST.

NEWARK, N. J.

dle and anvil. The gage is readily set up for use by plugging into any source of 110 volt alternating 50 or 60 cycle current.

Ward Leonard Rheostats

The Ward Leonard Electric Company, Mt. Vernon, N. Y., is now marketing the rheostat shown in the illustration. The construction employs a pressed steel plate, which forms a rigid base, durable but light in weight. The resistance element to which the contacts are welded, is enveloped in a fused-on vitreous enamel. The steel shaft turns in a graphitized bronze bearing burnished to close tolerances assuring a good running fit.

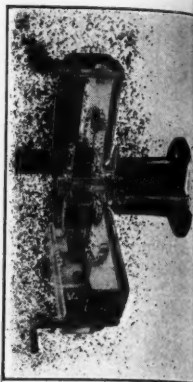
All parts are keyed and locked into slots milled across each end of the shaft, eliminating the use of set screws. Any effort to turn the shaft past the end of travel causes no strain on the bearing or contact drive arm, as the stop is on the driving side of the plate.

The functions of current carrying and contact pressure are entirely separate. A rigid, hard copper contact arm is held against the contacts by means of a large

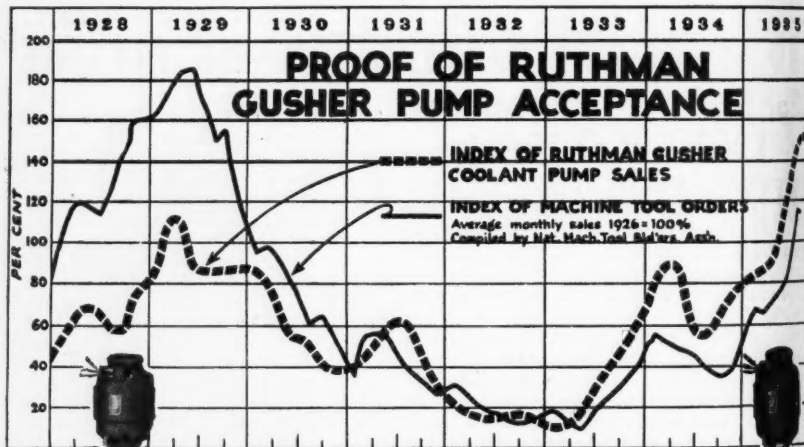
heat treated coil spring. The contact arm is double ended, giving a balanced construction with almost 360 degrees travel. Spacings and creepage distances meet all requirements for 600 volt service, and the rheostat is listed as standard by the National Board of Fire Underwriters.

The hand-wheel, 3 1/4 in. in diameter and 3 in. high, reduces the turning effort and prevents the operator coming in contact with the rheostat plate.

Rheostats can be furnished with complete enclosures, fittings for conduit connections and accessories for back-



Ward Leonard Rheostat



The chart shows real evidence of the rapidly increasing preference for RUTHMAN GUSHER COOLANT PUMPS for installation on original Machine Tool equipment. More Machine Tool Builders are turning to Gusher Pumps continuously.

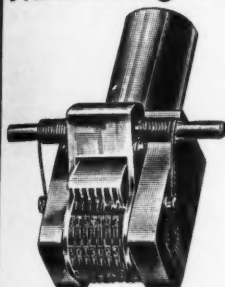
RUTHMAN GUSHER PUMPS are designed and guaranteed to handle water loaded with grit and abrasive materials. Write for details and prices.

Outside Mounted
Type
Model 11022

THE RUTHMAN MACHINERY CO., Cincinnati, Ohio

Model 11021
Immersing
Type

Numberall Automatic Numbering Machines



Cut your numbering costs by use of this automatic precision machine for perfectly aligned consecutive or repeat numbering.

Used in a punch press automatically advancing at each up-stroke. Marks untempered steel, metals, fibre, wood, etc. All sizes of figures or letters. Three to ten wheels. Ten figures or letters and blank on each wheel. Specify size and number of figure or letter wheels.

Write for latest circular and price list.

Numberall Stamp & Tool Co.

HUGENOT PARK Staten Island, N. Y.

SPRAGUE



ELECTRIC HOISTS

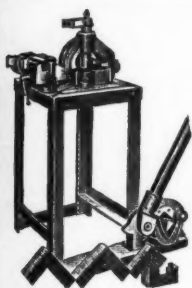
CLOSE HEADROOM TYPE, CAPACITIES: ¼ TO 2 TONS

Features: 1. Absolute minimum of headroom consistent with safe, durable construction. 2. Direct worm drive. 3. Few moving parts. 4. Totally enclosed. 5. Automatic Lubrication. 6. Noiseless operation. 7. Rope or push button control. 8. Anti-friction bearings. 9. Ball bearing trolleys with swivel yokes permit hoist to negotiate curves of small radius. 10. Hoist frame supported by trolley yokes and not suspended from king pin.

SPRAGUE HOIST DIVISION

SHEPARD NILES CRANE & HOIST CORP.

424 So. Schuyler Ave., Montour Falls, N. Y.



No. 455 Angle Iron Combination

Shears, Notches and Bends a 2" x 2" x ¼" angle iron in one minute flat.

Write for catalog on entire line.

No. 20 BALL BEARING PUNCH

Capacity ½" thru ½" iron

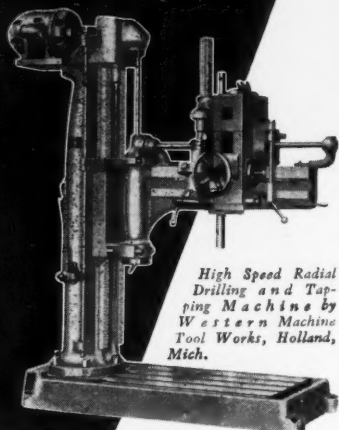


WHITNEY METAL TOOL CO.

110 Forbes St.

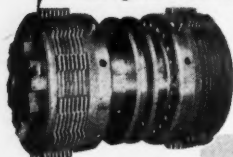
Rockford, Ill.

- ✓ EASIER CONTROL
- ✓ MAXIMUM POWER
- ✓ SIMPLER OPERATION
- ✓ SPEEDIER PRODUCTION
- ✓ GREATER PRODUCTION



High Speed Radial Drilling and Tapping Machine by Western Machine Tool Works, Holland, Mich.

This exceptionally fast driller and tapper, 2000 rpm of spindle, is equipped with Multiple Disc, Close Coupled Model, Twin Disc Clutches. Entirely enclosed and running in oil, these clutches operate at a constant speed, transmitting maximum power at any spindle speed. Operated from in front of the head, by the Western ball handle lever control, the Twin Disc Clutches not only insure easier operation, but speedier and greater production. Engaging either one of the clutches, located in the bevel gear, with this control gives forward or reverse direction to spindle. This is outstanding simplicity of operation. Write for specific recommendations. Engineering data on Request. Twin Disc Clutch Co., 1326 Racine St., Racine, Wis.



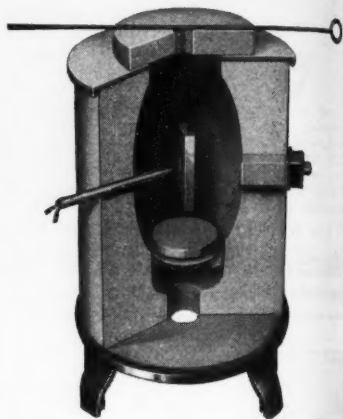
Close Coupled Duplex Oil Type Clutch

TWIN DISC
CLUTCHES

board, floor, concentric and motor drive. Fixed and adjustable auxiliary stops can be provided.

Interval Steel Treating Furnace

A steel treating furnace that heats entirely by radiation in a non-oxidizing atmosphere has been placed on the market by Bennett Insured Steel Treating Co., 130-132 South St., Newark, N. J. This furnace, to be known as the "Interval", is preferably gas fired and is said to reach and maintain high speeds



Interval Steel Treating Furnace

temperatures in an exceedingly short time and accordingly small cost. The furnace embodies a single chamber, the cylindrical interior being so constructed that heated products of combustion cannot come in contact with the pieces being heated.

The furnace is not provided with a hearth or floor; pieces are suspended by means of a wire and are heated entirely by radiation. A deflector at the base of the heating chamber, against which the fuel is impinged, permits products of combustion to flow upwards in close proximity with the concave walls and out through the upper opening. The manufacturer states that tools made from straight carbon steel, Hi-Carbon, Hi-Chrome and High Speed steels may be heated from minimum to maximum temperatures without danger of loss in size, pitting or oxidation.

The Interval furnace is equipped with an opening for pyrometer fire ends. The

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Alligator Brand Files are available in a complete line of Swiss and American patterns in all sizes, shapes, and cuts to fill every filing need. When you purchase these files, you do so with our guarantee that they have passed the highest tests as to shape, cutting quality and uniform hardness and are perfect in every respect.

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Newark, N. J.

MENDES QUALITY DIAMONDS *Always Sharp*

"DIAMOND" POINT
ANGLE TOOL

for

WHEEL DRESSING

REDUCE
GRINDING
COSTS

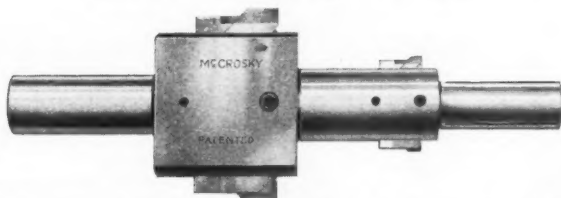


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McCROSKY Block Boring Bars With Centralizing V Lock



New and improved design of centering key locates and locks block in bar with extreme accuracy.

Block can be inserted or removed from bar without disturbing centering key.

Blocks hardened to resist wear and damage.

Send for descriptive Bulletin on Standard Bars and Blocks and special applications

McCrosky Tool Corporation, Meadville, Pa.

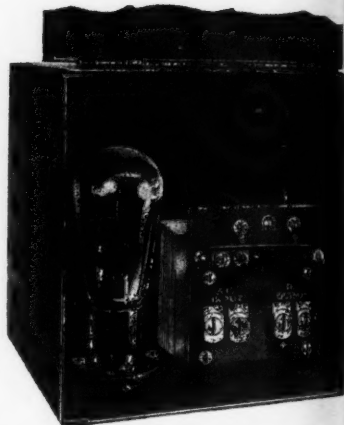
Centering Key with tapered V to engage V slot in Block

fire end may be placed in close proximity to the work-piece, thus affording correct optical comparison. An opening in the side of the furnace permits the heating of the ends of pieces where the ends only are to be hardened. The opening is closed with a plug when not in use. By removing the two top cover bricks and by removing the above mentioned plug, the Interval furnace is immediately converted into a lead, cyanide or salt bath furnace and will accommodate a pressed steel pot 6 in. in diameter and 12 in. deep, inside dimensions.

Ward Leonard Magnetic Chuck Rectifier

Ward Leonard Electric Co., Mt. Vernon, New York, announces the development of a rectifier for use with magnetic chucks. The device is said to provide an economical means for obtaining rectified alternating current from 110 volt, 60 cycle service. The rectifier is made in four sizes covering a range up to 1800 watts.

The unit is enclosed in a sheet steel cabinet with knock-outs for conduit connections and provided with a large hinged cover. The cabinet is arranged



Ward Leonard Magnetic Chuck Rectifier

for wall mounting. Standard full wave glass envelope rectifier tubes are used, the average life of the tube under normal conditions of service being approximately 18 months. Replacements are available.



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INVESTIGATE WILMINGTON FIBRE

This genuine vulcanized fibre possesses the quality necessary to insure the extreme accuracy required of parts fabricated on the screw machine. It is readily workable, though tough and very strong . . . and may be easily and economically threaded.

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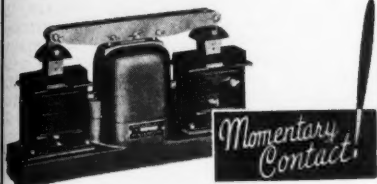
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Why a DOUBLE SOLENOID CONTROL VALVE ?



ASSURES SATISFACTORY SERVICE

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Quick-As-Wink

FOR AIR VALVES



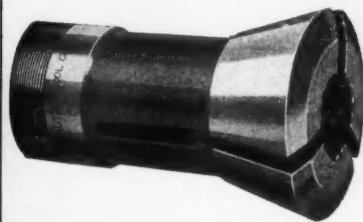
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Only Sutton Collets Are Diamond-Serrated



Sutton Diamond Grip Collets

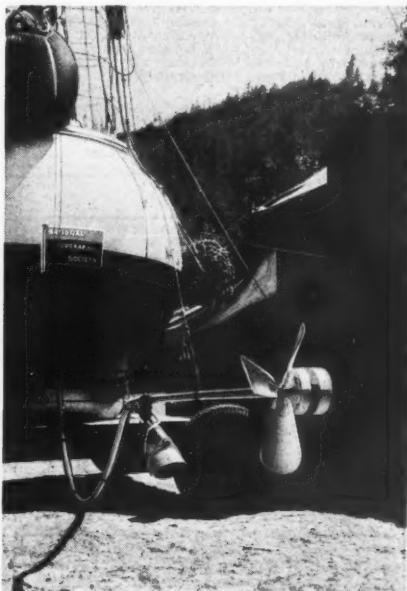
● Grip tighter with less chucking strain ● Eliminate slippage ● Last longer. Catalog No. 11 will show you how to get these advantages for your machines, also the full Sutton Line of screw machine accessories.

SUTTON TOOL COMPANY

2838 W. Grand Blvd., Detroit, Mich.

Master Motor Selected for the Stratosphere Flight

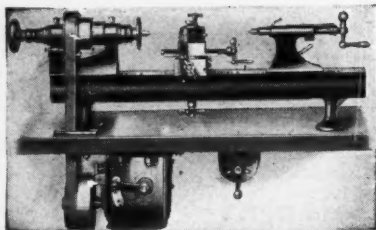
Probably you will never require a motor for a stratosphere flight. But, when you must have absolute dependability in a motor, you, too, would do well to let Master Engineers assist you in selecting the Master Guaranteed Motor that exactly meets your requirements.



This specially constructed Master Guaranteed Motor slowly revolved the giant stratosphere balloon so as to maintain even temperature conditions, and to facilitate the taking of scientific observations in any desired direction.

THE MASTER ELECTRIC COMPANY
DAYTON OHIO U.S.A.

"Stark"



HAVE YOUR STARK LATHE OR MILLER RECONDITIONED NOW

We restore them in most cases almost to the accuracy of new ones. Write us about repairs. Stark Precision Bench Lathes (8 sizes) Spring Bind Heads, for fast chucking. Auto Turret Heads. Motor Drive Unit, fits any bench lathe. Milling Attachment. Diamond Drills. Diamond Die Polishers. Collets. Chucks. Special Precision Tools. "Electroblast" Torch and Muffle Furnaces.

STARK TOOL CO.

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Standardized Die Sets, embodying many exclusive features, and a listing of more than 95,000 stock sizes, afford a service that is unsurpassed.

Send for Our New 208 Page Catalog.

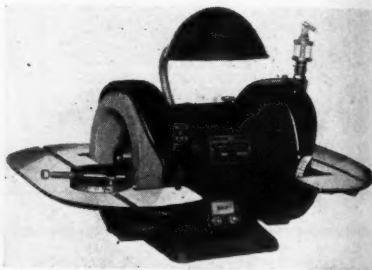
E. A. Baumbach Mfg. Co.

1806 S. Kilbourne Ave., Chicago, Ill.

Model AA Prosser Widia Cemented Carbide Tool Grinder

The Model AA Cemented Carbide Tool Grinder shown in the illustration has been added to the line of equipment market by Thomas Prosser & Son, 15 Gold St., New York, N. Y. The grinder is equipped with two quick setting tapers, carefully planed and slotted with graduated indexes. The design of the machine permits both rough and finished grinding of cemented carbide tools with cup wheels to accurate angles with flat surfaces. An oil feeding attachment is furnished for use when diamond wheels are used, making it possible to keep the face of the diamond wheel well oiled when in use.

The finishing wheels may be either



Model AA Prosser Widia Cemented Carbide Tool Grinder

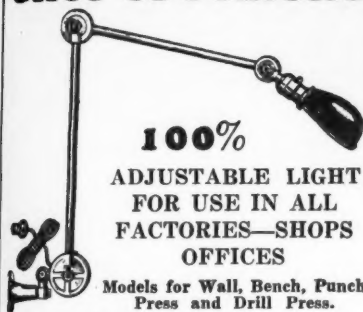
fine grain silicon carbide or diamond impregnated grinding wheels, or the grinder may be supplied with other types of grinding wheels for grinding high speed steel and other tools. It has also been found excellent for general toolroom work. The model shown is equipped with two silicon carbide wheels and a 110-volt A. C. 60-cycle 3400 r.p.m. motor. Standard equipment includes the motor, lamp, combination wheel dresser, holder and protractor. A pedestal can be supplied upon request.

Acco Utility Jack No. 35

A utility tool suitable for a host of applications involving stretching, pulling, binding or lifting is announced by the Welded Chain Division of American Chain Company, Inc., Bridgeport, Conn.

This device is of simple and sturdy construction and is suitable for working loads up to 4000 pounds. The complete unit includes the frame with operating

NEW! SHOP SPOTLIGHT



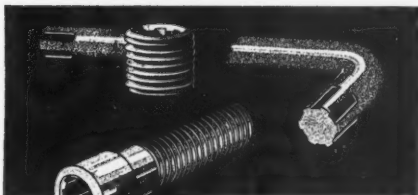
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ADJUSTABLE LIGHT
FOR USE IN ALL
FACTORIES—SHOPS
OFFICES

Models for Wall, Bench, Punch
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Price F. O. B. Factory
SINGLE LOTS \$3.25 each
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**CHICAGO DIE CASTING
MFG. CO.**

2504 W. MONROE ST. CHICAGO, ILL.



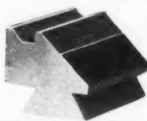
HEAT TREATED By Pioneers In Heat Treating

Bristo Screws are made in the same factory as Bristol's Pyrometers. A recognized standard for controlling the heat treating and so the quality of metal products throughout industry, Bristol's Pyrometers are the result of forty years' experience in constructing precision instruments to serve the heat treater,—an experience that naturally is reflected in the quality of Bristo Screws. The Bristol Company, Waterbury, Connecticut.

BRISTO

TRADE MARK REG. U. S. PAT. OFF.

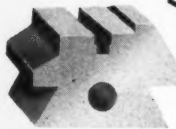
SOCKET HEAD SET AND CAP SCREWS



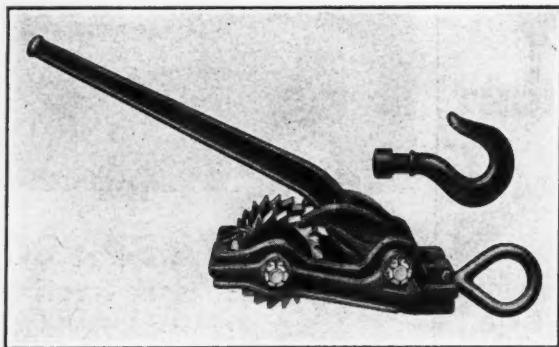
WEL-DON SCREW MACHINE TOOLS

For high-accuracy production work—and more of it between grinds. Send us "part-prints". We'll give you quick delivery—and design service, too, if you wish.

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THE WELDON TOOL CO., 321 Frankfort Avenue, Cleveland, Ohio



Acco Utility Jack No. 35

parts, a ten foot stretcher chain and five foot anchor chain.

When in use the stretcher chain fits over teeth in the sprocket wheel and power is supplied by raising and lowering the handle. Axle of the handle being eccentric transmits power through two pawls engaged in the wheel. One pawl is always in position, therefore, the wheel cannot slip.

The ACCO Utility Jack without chains

weighs thirty-four pounds.

Watson-Stillman Self-Contained Hydraulic Press

A self-contained hydraulic press, illustrated, has been placed on the market by the Watson-Stillman Co., Roselle, N. J. This press is a complete, compact unit, the press being mounted on a steel base which brings the platens to a convenient working height. The base is not only a support for the press, but also forms a housing for

the pump and motor as well as the operating valves. The lower part of the base forms the supply or surge tank for the pumping fluid, which should be a light oil. Cooling coils are supplied to keep the temperature of the oil at the proper point for most efficient operation. The pump furnished with the equipment is of the gearless type, as quiet in operation as the motor that drives it.



COLONIAL DRILL JIG BUSHINGS

A. S. A. STANDARD

You are sure of getting accurate and dependable drill jig bushings when you order COLONIAL. Made of High Grade Tool Steel. And when you order COLONIAL, you'll get them quickly.

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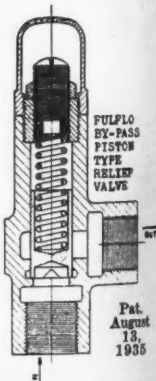
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145 JOS. CAMPAU ST.
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FULFLO Non-Chattering By Pass Piston Type Relief Valve

THIS valve is made in pipe sizes from $\frac{3}{8}$ to 3" and is suitable for pressures from 10 lbs. to 1,000 lbs. Adjustment can be made by removing cap and turning adjustment screw at top of valve. The cylindrical piston seat closes off the port in a shearing manner, and does not seat abruptly against the body of the valve, thereby, relieving a pounding or chattering noise as ordinarily caused by standard valves using a disc seat.



Pat.
August
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1935

Fulflo Specialties Co., Inc.
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This New Catalog Will Help You Select Better End Mills

Superior quality of Putnam High Speed End Mills produced by methods accumulated thru many years of fine tool designing and manufacturing assure you of Maximum Production, Higher Speeds, Faster Feeds, and Smoother Finish.

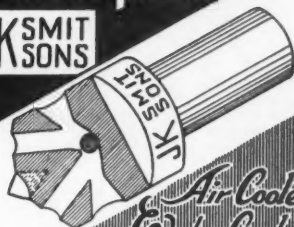
The New Putnam End Mill Catalog is ready for you. Write for your copy today.

Putnam Tool Co.
2981 Charlevoix Ave.
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SONS**



*Air Cooled
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Diamond HOLDER

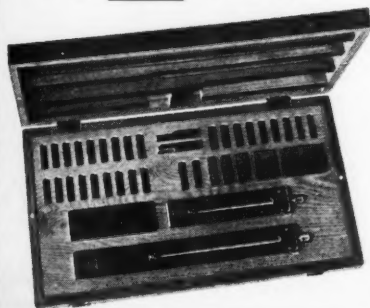
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A GAGE SET YOU CAN AFFORD



A NEW No. 2 Gaging System Set designed to provide the smaller shops with the highest standards of measurement — at a price you can afford. The 35 blocks and 4 accessories make 80,000 different sized gages in steps of .0001 inch, from .300 inch minimum to more than 8 inches. Two adjustable holders for maximum convenience, and jaws for internal and external measuring.

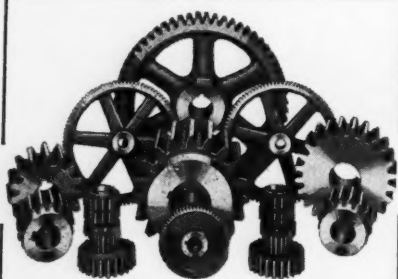
Working Set (in case), \$185 Inspection Set (in case), \$232

Write for complete information

JOHANSSON
GAGE BLOCKS and ACCESSORIES

Manufactured, sold and serviced in
the United States and Canada by

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Unlimited Assortment of Gear Patterns, Hobs and Cutters Available

We have on hand a great variety of patterns for cast or moulded tooth gears of all types and the most complete assortment of hobs and cutters in this country.

This means a saving of time and money to you—quick action and prompt delivery when any of our standard or special size gear patterns and tools are used. And, longer gear life with IXL Quality. Complete information in the BIG IXL HANDBOOK or SPECIALIZED LITERATURE.



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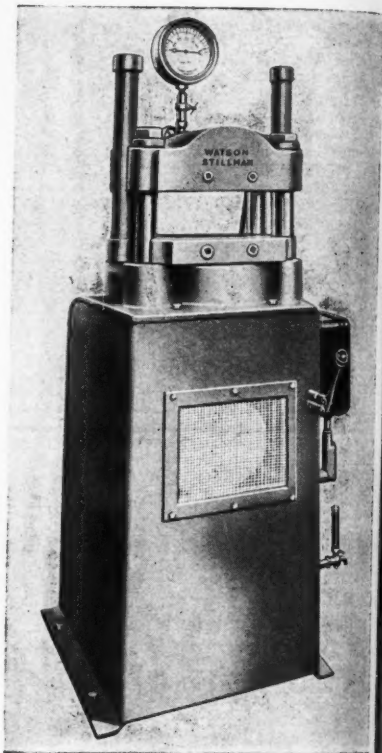
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Name.....

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The pump is started by means of a conveniently located push button control, and the movement of the press platen is controlled by a single lever. At one position, this lever admits the pump pressure to the press cylinder and in the reverse position the pressure is released allowing the platen to return. At the same time the pump is by-passed.



Watson-Stillman Self-Contained Hydraulic Press

permitting it to run continuously. The return of the press platen is accelerated by springs mounted in the housing on each side of the press. The press is built in four sizes: 40, 60, 85 and 100 tons capacity, with platens 12x12 or 14x14 inches.

Guardian Flexible Drive Coupling

An improved type of drive coupling for fractional horse power motors, de-



Rollway PUMPS

Manufacturers in the metal working industry who are not pumping their lubricants and coolants through Rollways are overlooking an opportunity.

Those who do use Rollways find that they get all they have been in the habit of expecting—**PLUS SOMETHING MORE.** May we send you a list of industrial leaders who have found this to be true?

PIONEER

ENGINEERING AND MFG. CO.

31 Melbourne, Detroit, Mich.

Also Centrifugal and Hydraulic Pumps



The New Stackbin Section

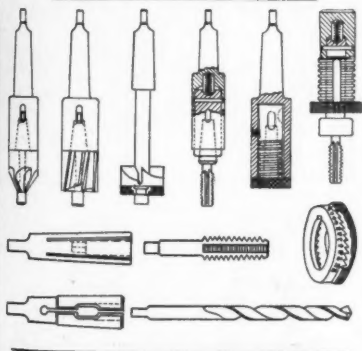
Patented

MAKES A STOCKROOM AS EASY TO BUILD AS A SECTIONAL BOOKCASE

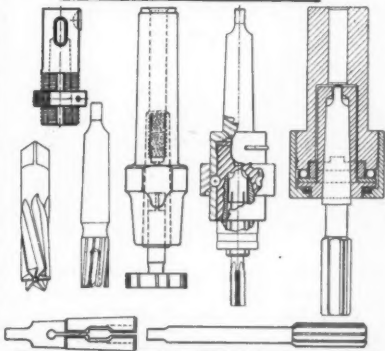
The Stackbin Section is designed so that one section-nests-into-the-other, and sections nest deeply enough so that several placed one on top of the other provide a substantial unit. Ideal for temporary stockrooms near the job. Base separate. Counter top can be supplied. Write for circular and prices.

STACKBIN CORPORATION
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SCULLY-JONES & CO.



SCULLY-JONES & CO.



(Reproduction of cross section of Catalog No. 105)

A new 8½"x11" 144 page catalog containing detailed engineering information covering a complete line of production tools for drilling, tapping, reaming and counterboring.

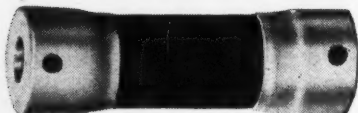
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SCULLY-JONES AND COMPANY

1907 South Rockwell Street

Chicago, Illinois

signed to eliminate transmission of noise and motor torque vibration from the motor to the driven shaft, has been



Guardian Flexible Drive Coupling

developed and is now being introduced by the Guardian Utilities Company, 1023 East 46th Street, Chicago, Ill. Made of flexible rubber, treated to resist action of oils, and offered in various lengths to eliminate the extra cost of shaft extensions.

The new device will operate under reasonable lateral or angular misalignment without binding, friction or noise. It is particularly suitable for use with cushioned or spring motors, either base or flange mounted, and affords quick convenient alignment of the motor and the driven shaft.

Custom made in lengths from 2½ inches up, and with any combination of bores, ⅜, ¾, 1 and 1½ inch. The

coupling has been successfully applied to oil burners, stokers, printing equipment, small pump units, bakery machines, etc.

Tungsten Carbide Tipped Lathe Centers

Tungsten carbide tipped lathe centers have been added in regular production by the Tungsten Carbide Tool Co., 7171 East Six Mile Rd., Detroit, Mich. Tipped lathe centers have been produced on special order by this organization for some time past. Demand for such centers however, as the result of operating achievements, has now grown to such a



Tungsten Carbide Tipped Lathe Center

proportion that the centers have been placed in routine production.

Interest in this development seems to be about equally divided for both finish-



THE NEW SHELDON 11" LATHE

• 11¼ in. Swing... Two bed lengths... 24 and 36 in. center distances... 1 1/16 in. Spindle Hole.

Semi-quick change gear box with gears for cutting 4 to 80 threads per inch.

Ask for Bulletin No. 23.

Sheldon Machine Co.

3253 Cottage Grove Ave.

CHICAGO,

ILLINOIS

Anderson Improved Balancing Ways No Leveling Required

A simple and excellent device for balancing straightening and truing.

They are made in the following sizes:

Swing	Greatest Distance Between Standards	Capacity in lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	46 in.	5,000
96 in.	88 in.	10,000



Four Chilled iron discs rotate on sensitive special bearings

Write for Full Information.

Mfd. **Anderson Bros. Mfg. Co.**
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Lathe

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Co., 7171
Tipped
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Center

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sizes:

Capacity
in lbs.

1,000
2,000
2,000
5,000
10,000

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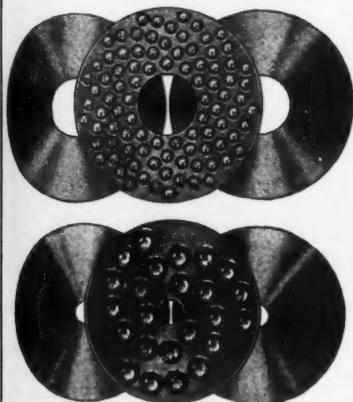


SHEAR CUT Single and Double END MILLS

**They cut
faster. They
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smooth fin-
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way they
are ground.**

Send for a new
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other sizes and
styles.

Progressive Tool & Cutter Co.
FERDALE MICHIGAN



BALL THRUST STEP BEARINGS

Special Bearings Made To Order—Any quantity
"one bearing or one thousand".

Your present bearings duplicated. Send sketch
or worn sample, regardless of condition, for
quotation.

Catalog Upon Request.

THE GWILLIAM CO.

358 Furman St. Brooklyn, N. Y.

WHAT ARE THE VARIOUS COATED ABRASIVES?

What Are Their Uses?

FLEXIBILITY

By E. B. GALLAHER

Editor, Clover Business Service
Treasurer, Clover Mfg. Co.

IN OUR LAST AD we told you about the
abrasive "Emery." We have already de-
scribed the various Abrasives in use and
the backings employed—our subject today
is flexibility.

● When glue and grain are applied to
either a paper or a cloth backing, the
finished product is, naturally, stiff, the
glued surface, in addition, being brittle.

● When we attempt to make a sharp bend
in such a sheet, an irregular break in the
coating will result, being more evident in
the coarser materials where the coat is,
necessarily, heavy.

● Maximum work-value can only be at-
tained where the coating, or glue bond, is
not broken; but in many operations this
is not practical—a more flexible material is
essential, even at the expense of work-
value.

● As a result, there is probably more
demand for a flexible coated abrasive than
for the stiff, unflexed material.

● Both flexed and unflexed material can be
supplied, but it is necessary that you specify
which you require when ordering, other-
wise, you are apt to get what you don't
want, and then blame the material.

● Coated Abrasives are flexed by drawing
the back of the material over a sharp edge,
which has the effect of cracking up the
glue bond into small pieces. The sharper
the edge, the more completely will the
surface be cracked up.

● In flexing, it is usual practice to draw
the material over sharp edges in diagonally
opposite directions—thus the entire surface
becomes converted into tiny islands, each
stuck to the backing and each holding its
share of abrasive grit.

● Anyone can take a stiff sheet of coated
abrasive and draw it over the edge of a
bench diagonally in two directions to ren-
der it flexible. Or a sheet which has been
flexed in the factory can be made still more
flexible in this way.

● Remember two things: (1) you must
always specify flexed
goods if you require
them, and (2) you
must not expect to
obtain the same
work-value from a
flexed sheet—the more
flexing we do, the less
work you will get out
of the material.

Gallagher

CLOVER MFG. CO.,

NORWALK,
CONN.

Also Makers of the Famous
CLOVER GRINDING AND LAPPING
COMPOUNDS

High Speed Automatic Feeds Will Double or Treble Your Punch Press Production

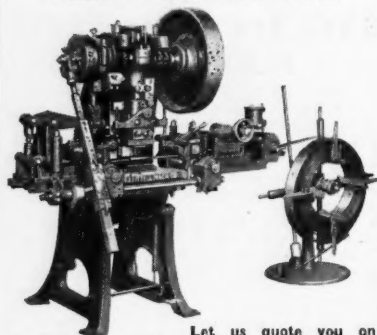


Illustration of Littell No. 3 Rack and Pinion Roll Feed mounted on a press, together with a Littell Automatic Centering Reel.

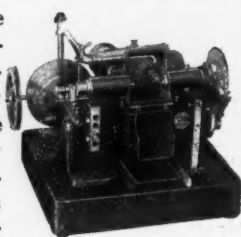
Let us quote you on your Roll Feed, Dial Feed, and Magazine Feed requirements for any make or size of punch press. Write today for our catalog No. 36.

F. J. LITTELL MACHINE CO.

4127 RAVENSWOOD AVENUE, CHICAGO
Mfr's of Punch Press Air Valves and Reels

"Waltham" Pinion Cutting Machines

Are made with a variety of equipments. They will make the two or three successive cuts



needed for watch pinions or may be used for fine pitch gears up to $1\frac{1}{2}$ " diameter. There is also a 4" size. If you will describe your work we will send details.

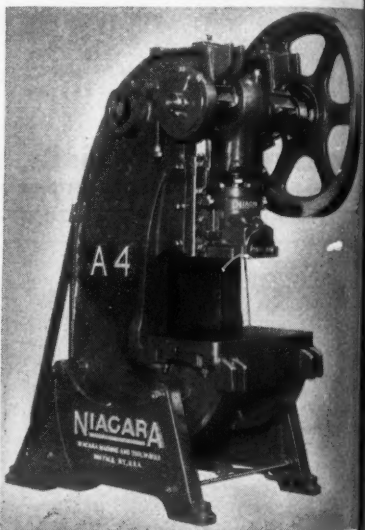
WALTHAM MACHINE WORKS
WALTHAM, MASS.

ing and roughing operations. The long life and minute wear of the tungsten carbide tips enables maintenance of accuracy in production for finishing operations over long periods of time.

For roughing, the new centers permit extremely heavy cuts. Frequently the amount of hogging possible is limited by the ability of the centers to stand the heavy side thrusts without excessive wear. The limitation is removed with the new tipped centers.

Niagara No. A-4 Inclinable Open Back Press

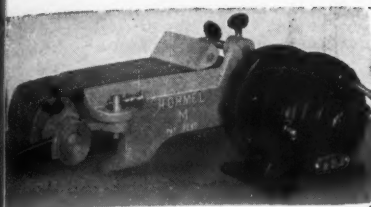
The No. A-4 Inclinable Open Back Press illustrated herewith has been added to the line of presses built by the Niagara Machine & Tool Works, Inc.



Niagara No. A-4 Inclinable Open Back Press

Northland Ave., Buffalo, N. Y. The frame of the No. A-4 press is scientifically designed for strength and rigidity and is equipped with a 4-in. diameter forged and ground main shaft.

The No. A-4 Inclinable Press follows the same general design as the other sizes in the Master Series line and includes a quick-acting six point engagement clutch, new type slide with breech block die clamp and equal support for the die from center to front and center to rear, double "V" gibbs, motor drive



• NEW An Inexpensive ABRASIVE BAND GRINDER . . .

"Built Like a Machine Tool"

The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on the belt. Ball bearing throughout, equipped with ALEMITE LUBRICATION, complete with grease gun.

Write for illustrated folder on this and other styles and sizes.

HORMEL-M GRINDER
WALLS SALES CORP.

98 WARREN ST.

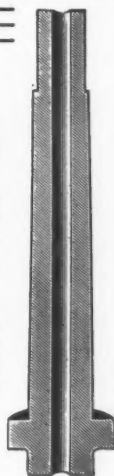
NEW YORK, N. Y.

Made by SPECIALISTS

Manufacturers everywhere specify American Hollow Bored Forgings because they are made by specialists . . . men who know real accuracy . . . and because the price is right.

It is good business to investigate American Hollow Bored Shafts and Forgings for your needs. Send us your blueprints. Data and prices will be furnished without obligation.

American
Hollow Boring Co.
2000 Raspberry St.
Erie, Pennsylvania



High
Speed

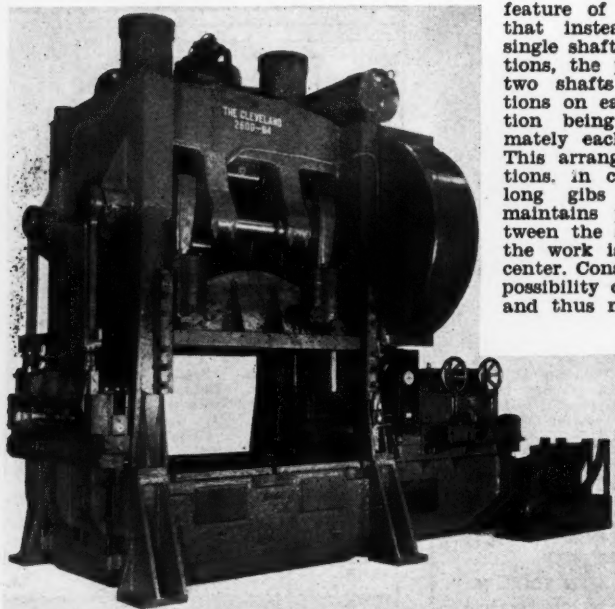
TAPPING

Attachment for drill presses

New tapping attachment taps holes perfectly at tremendous speeds. Has friction drive and reverse with double-cone, cork-faced, friction clutch; ball bearings; and three point balanced heat treated gear reversing mechanism. Simple to operate. Economical to maintain. Smooth, sensitive and compact. With all parts interchangeable. Precision-made. Many other styles for every need. Three sizes.

PROCUNIER
SAFETY CHUCK COMPANY
12 South Clinton
Chicago, Illinois

Write
for
literature



Cleveland No. 260-D-84 Four Point Suspension Press

on top, self-contained anti-friction back gear, compensating brake, and one-man inclining device equipped with anti-friction bearings.

Cleveland No. 260-D-84 Four Point Suspension Press

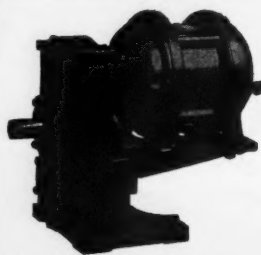
The No. 260-D-84 Four Point Suspension Blanking and Forming Press shown in the illustration is now being built by the Cleveland Punch & Shear Works Co., 3917 St. Claire St., Cleveland, Ohio. The

feature of the press consists that instead of the customary single shaft with but two connections, the press is designed with two shafts having two connections on each shaft, one connection being located at approximately each corner of the slide. This arrangement of the connections, in conjunction with extremely long gibs and other features, maintains perfect alignment between the slide and bed wheels so the work is in the center of the center. Consequently there is no possibility of the dies overlapping and thus not only is the life of the dies greatly lengthened but extreme accuracy is assured for the work produced.

The press shown is arranged with an electrically controlled air-operated friction clutch and brake and is equipped with self-contained pneumatic drive cushions in the bed. The slide air counterbalanced, the air supply being obtained

from a compressor mounted on the top of the press. This feature makes the press independent of the plant air supply and permits the press to be operated regardless of whether the shop air system is in operation.

The press is equipped with a double roll feed having supplementary rolls for leveling or straightening the material before it reaches the dies, and is arranged with an automatic uncoiler. A scrap cutter is provided on the opposite side of the press for shearing off the waste after the piece has been blanked.



CULLMAN SPEED REDUCERS

for

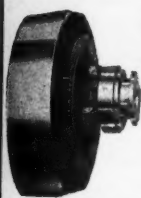
Motors From $\frac{1}{8}$ to 15 H. P.

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Cullman Wheel Company

1336 ALTGELD ST., CHICAGO, ILL.

"EDGEMONT" SERVICE TESTED FRICTION CLUTCHES



*Power and
Endurance
at any
speed*

In starting heavy loads from rest, high speeds or frequent operation this "Edgemont" Type SF Disc Clutch is dependable. Try it on that next hard job. Special attention of our Engineering Department assures successful applications.

Send data now for recommendations

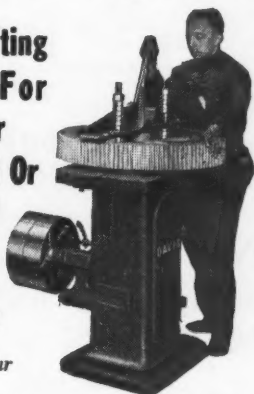
Edgemont Machine Co.

2100 HOME AVE.

DAYTON, OHIO

A New Keyseater

With Tilting
Table For
Either
Straight Or
Tapered
Bores



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For
Circular

Davis Keyseater Co.

Exchange and Glasgow Sts.
Rochester, N. Y.

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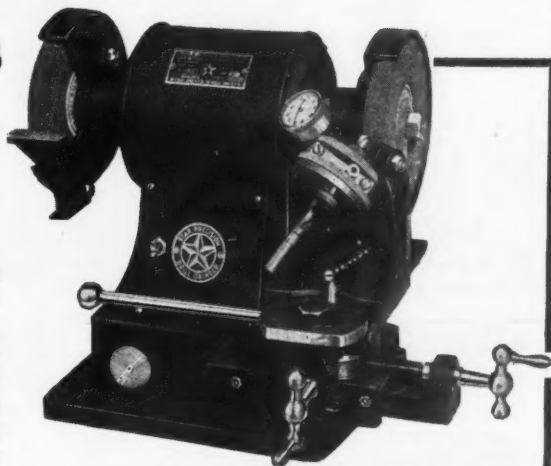
81 SIZES OF

Drills

No. 31 to 1/2"

NEW!

This new Star Precision Grinder puts drill grinding on a production basis. Its simplicity and accuracy saves as high as 50% on drill costs and insures uniform accuracy that guarantees perfect holes.



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STAR MACHINE & ENGINEERING CORP.

Division of Star Electric Motor Co.

BLOOMFIELD AVE.

BLOOMFIELD,

NEW JERSEY

Wet Production Grinding



Cylindrical, Internal, Surface and Coilet (centerless) production grinding.

TOOL RECLAIMING by special wet process. 50% off

Net. **CUTTER GRINDING**—Tools, Reamers, Hobs. An immense stock of used **H.S. CUTTERS** like new at 1/2 price. Send for price list—now.

Machinists' Tool Sharpening Co.

3038 W. VAN BUREN ST., CHICAGO, ILL.

NOW . . . you can equip your **MILLING MACHINES** with the **NEW L-W DIVIDING HEAD**

at a very **LOW COST**



• The **L-W 10 1/2" Dividing Head**—swivel graduated up to 180°—is accurate and well constructed. The graduated spindle and Index plunger provide quick indexing. Has oversize worm wheel and worm. Highly recommended!

Write for Information and Low Price!

L-W CHUCK CO.

20 N. St. Clair St. • Toledo, Ohio

or formed. The feed arrangement and press operation are synchronized through an interlocking system so that in the event that the material fed through the press is insufficient, the ram will stop instantly and remain stopped until correction has been made and the operator starts the press again. The rolls of the machine illustrated are arranged to feed 6 in. minimum and 60 in. maximum, but they can be furnished to feed any length or width depending on the size of the machine and the operation.

Trico Opto-Matic and Drip-Drop Oilers

The Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee, Wis., has announced a new addition to its line of Opto-Matic Constant Level Lubricators. The new model, which is known as the No. 3, greatly increases the number of applica-



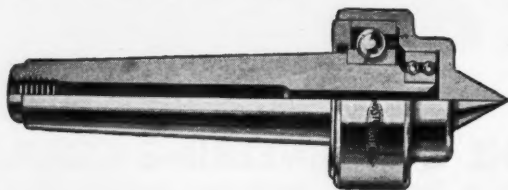
Drip-Drop Bottle Type Oiler



No. 3 Opto-Matic Oilier

tions for maintaining constant level lubrication on ring or ball bearing shafts. The firm is also presenting a new bottle type oiler known as the "Drip-Drop" for solid, wick or wick-packed bearings. The Drip-Drop Oilier

STURDIMATIC LIVE CENTER for LATHES, GRINDERS and MILLING MACHINES



It turns with the work. Eliminates friction of dead center.

Lowest possible overhang prevents vibration and chatter.

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STURDIMATIC TOOL COMPANY

5222 THIRD ST., DETROIT, MICHIGAN

4 Holes at Once

With a
U. S. Multiple
Drill Head

You can save money and time with U. S. Multiple Drill Heads, standard or special according to the job.

This head is for drilling 4 holes at once with other U. S. heads as many as 50 holes can be drilled at one time.

Send blueprints of your jobs and we will show you what you can save with U. S. Heads.

The United States Drill Head Co.

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UNIVERSAL COLLET CHUCKS

GRIP AS STRONG
AS
SOLID
STEEL

CONCENTRIC
WITHIN
.001

FOR
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MILLS

KEY WAY
CUTTERS

AND NITRIDED
CENTER POINTS

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FRANKENMUTH, MICH.

THIS No. 253 CHICAGO STEEL PRESS

Will Do 40% to 60% of
the Forming Work Turned
Out by the Average Shop

This compact, ruggedly built, 48", No. 14 gauge capacity, Chicago Steel Press brake is an economical and profitable production unit. It is ideally adapted for rapidly forming metal sections such as in stoves, refrigerators, soda fountains, steel cabinets, metal furniture, steel boxes and a great variety of sheet metal specialties. Variable speed drive operates from 17 to 50 strokes per minute. Precision built of highest quality materials by master craftsmen.

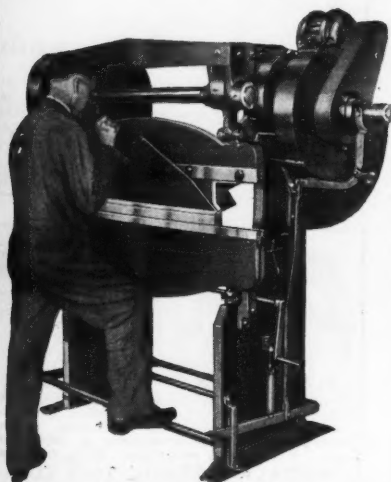
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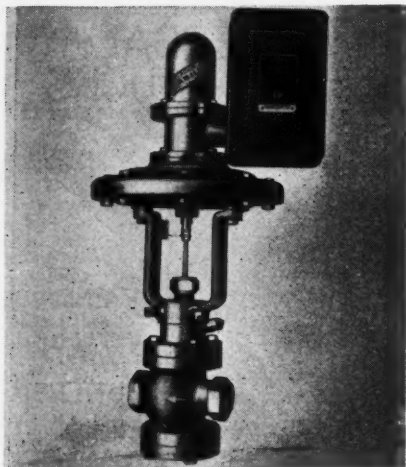
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COMPANY**

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Foxboro Vernier Valvactor

drops oil on the bearing from the top exactly as the bearing needs it and eliminates daily oiling by the hand method. The Drip-Drop will fit 95 per cent of all

installations without drilling or tapping. It is made in three sizes.

Foxboro Vernier Valvactor

Illustrated herewith is an accessory designed to insure the accurate and smooth operation of air-operated control valves which is now being marketed by The Foxboro Company, Foxboro, Mass. The accessory, known as the Foxboro Vernier Valvactor, is said to eliminate valve sticking and to assure half-line valve positioning. It enables throttling-type air-operated control instruments to make small gradual adjustments of the control valve position regardless of friction or hysteresis. It is claimed that the air from the control instrument need change as little as $\frac{1}{2}$ in. of water to cause correct positioning of valve and force the stem to take a position within 0.001 in. of the previous position.

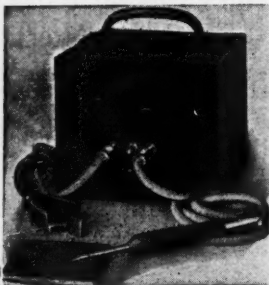
The Vernier Valvactor is said to guarantee exact valve response where the valve stem packing must be very tight to prevent leakage, where the fluids are viscous or contain solids, and where friction is otherwise unavoidable. In other words, the Valvactor provides an added assurance that the valve positively will not lock itself in one position. The use of the air relay in the Vernier Val-

MARK IRON, STEEL, ETC.

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THE ORIGINAL ELECTRIOT-ETCHER

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LOW
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ELECTRIC HAMMER AND DRILL

Drills in concrete, masonry, metal and wood. The drill you need for expansion bolts and screw anchors—installing machinery, fixtures, wiring, piping, etc. Invaluable as maintenance tool. Every plant needs one. Write for prices.

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MADE TO
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LOWEST COST
LONGEST LIFE
EASILY REPLACEABLE
THERE'S A SIZE FOR
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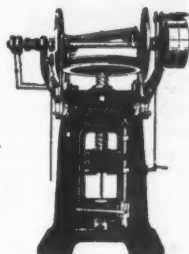
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Manufactured by

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THE 2 IN 1 WASHER

HERE is the winning lock washer combination — locking in its most positive form, plus the resilient tension of many powerful springs.

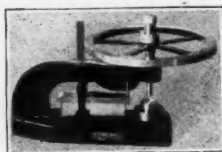
The magnified tongue tells the story. Imagine the pressure required to spring each tongue—and how this pressure drives the sharp teeth into both nut and work. Imagine the tremendous resilient spring tension set up by many tongues—live spring tension that compresses the parts so there's not a chance for a squeak or a rattle. Only a wrench can loosen nuts set down on Everlock Washers.

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Positive
Locking

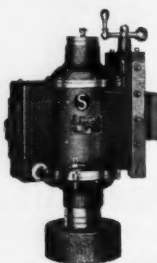
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actor assures fast and positive operation because an ample supply of air is always available.

The unit is mounted in a cast aluminum weather-proof case. The case is also available in gas-tight construction properly vented so that the Valvacor may be operated indoors on a gas supply with the vent piped to a safe spillage point. The Valvacor can be installed very easily to valves in the field, with but little interruption to service.

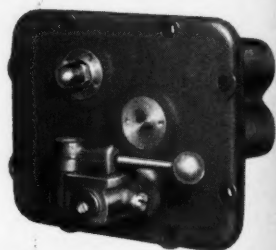
Sundstrand Hydraulic Equipment for Machine Tool Feeds

Complete hydraulic equipment for machine tool feeds and other applications has been developed by the Sund-



Sundstrand Hydraulic Pump

strand Machine Tool Company, Rockford, Ill. The equipment includes the Sundstrand Pump and Control Valve shown in the illustrations. The Sundstrand Hydraulic Pump is a variable displacement unit which provides adjustable feeds and a constant dis-



Sundstrand Hydraulic Control Valve

placement unit which provides rapid traverse. Both units are incorporated in a single housing and are driven by a single shaft, there being only two revolving parts in the entire mechanism.

The variable displacement unit is an entirely new design of the multiple piston type, designed to provide a positive uniform feed. Two pre-set rates of feed

operation
is always
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Valvactor
gas supply
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Valve

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"OUTWEARS the best Bronze Metal"

20 years



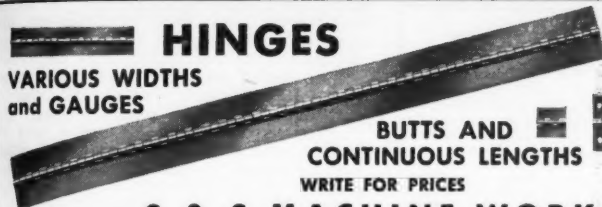
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ARGUTO OILLESS BEARING CO.

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VARIOUS WIDTHS
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BUTTS AND
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LOOK into the money-saving opportunities afforded by Bunting ready-to-use products. ● There are over 600 different sizes of Bunting Bronze Standardized Bearings. Completely machined and finished, instantly available from stock, these cut cost, time and trouble in both production and maintenance operations. Write for catalog. ● The labor cost you save on a Bunting machined and centered bar is far more than the cost of the metal. Investigate. There are 121 stock sizes of Bunting Cored and Solid Bronze Bars. Write for catalog. ● If it's Babbitt, try one bar of Bunting Babbitt and see for yourself what thousands of others have gratefully learned. Ask the Bunting mill supply wholesaler or write for data.

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WHAT ACTUAL TESTS HAVE PROVEN

- Automatically compensates for mis-alignment between the machine spindle and the work.
- It reproduces the actual size of the taps or reamers, because it allows the spindle of your machine to float into perfect alignment with the work.
- Tools cutting without hindrance from misalignment will produce uniform and accurate sizes.
- It prevents taps and reamers from breaking and eliminates bell-mouthed and oversized holes. It increases production and cuts tool costs.

Used for tapping, reaming and die head floating. Shanks, straight and Morse taper. Specials furnished to fit all machines.

Try one on your toughest job. It tells the "hole" story.

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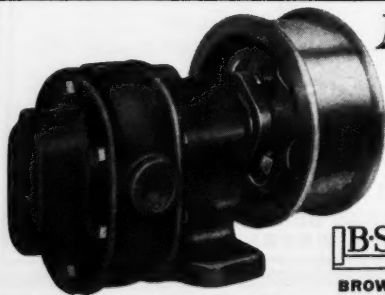
are available, both of which are adjustable throughout their entire range. The constant displacement unit is a Sundstrand Rota-Roll Pump, the operating principle of which comprises a roller that revolves in positive contact with a rotor or ring in the manner of a roller operating against the outer race in a roller bearing, thus providing a smooth rolling action and eliminating sliding blades and gears. Both the piston and constant displacement units are built to high standards of precision and are quiet in operation.

The Sundstrand Control Valve is said to provide rapid approach, feed, adjustable dwell and rapid return. A second or slower feed may be obtained and operation of the feed and rapid traverse sequence is controlled by adjustable dogs. Jump feed or rapid traverse between intermittent cuts may also be obtained by means of trip dogs. The control valve consists of pilot and reversing and selector valves all of which are operated from the low pressure source.

The Sundstrand Hydraulic Circuit is self-locking, providing smooth, uniform feed, shockless high speed traverses and is designed to prevent the tool from jumping ahead at the completion of a cut or during an intermittent cut. "Climb" cutting on the milling machine is also possible with this circuit, due to the fact that slides do not jump ahead as the tools break through.

Starbuck Rotary Pipe-Hole Saw

The Rotary Pipe-Hole Saw shown in the illustration has been developed by R. M. Starbuck & Sons, Inc., P. O. Box 1331, Hartford, Conn., for the express purpose of cutting holes for pipe through floors, ceilings and partitions. The feature of the tool consists in that it will cut through nails and through metal



Now-Higher Speeds

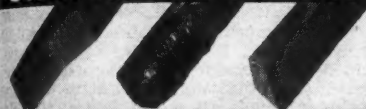
up to Usual Motor Speeds
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ROTARY GEARED PUMPS
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... A Tool With Triple Life

WITH a shank of ordinary scrap steel, a deposit of "Toolweld" and a grinding operation, shops are now turning out their own tools for as little as 25 cents. Super-speed cutting edges of tools, blades and dies, built or re-built by "Toolweld" are lasting three times as long as those of high-cost tool steel. Costs have been cut as much as 50 per cent. Get these savings! Write for details today.

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Highest quality, accurately cut Standard Stock Knurls ready for immediate shipment. Reed Special Finishing Process after hardening insures longest wearing Knurls producing best work. Special Knurls made to specification. Send for Circular.



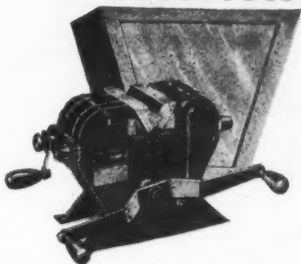
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Ask your jobber to demonstrate the type of Clipper lacing equipment best suited to your own plant needs.

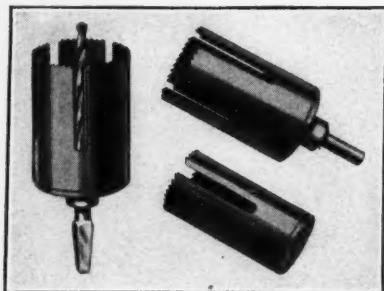
CLIPPER BELT LACER CO.
GRAND RAPIDS, MICHIGAN

Clipper

Lacing Equipment



ceilings without injury to the tool. The saw is of extremely tough steel and may be resharpened with a file. The successful operation of the rotary pipe-hole saw is due largely to the long narrow slots in each cutter. The slots provide an escape



Starbuck Rotary Pipe-Hole Saw

for the chips and dust as fast as it accumulates. The saw is made in five sizes, for $\frac{3}{4}$ -in., 1-in., $1\frac{1}{4}$ -in., $1\frac{1}{2}$ -in. and 2-in. pipe and may be used either in a hand brace or in an electric drill.

LAPPED & POLISHED DIAMOND BORING and TURNING TOOLS



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● For boring and turning all non-ferrous metals, bakelite, hard rubber, etc. Strong and keen cutting. Guaranteed to perform satisfactorily.

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Purolator Air Separator for Sand Blast Air Lines

Motor Improvements, Inc., 365 Frellinghuysen Ave., Newark, N. J., has developed a Purolator Air Separator for use with sand blasting equipment which is said to result in a better product and considerable reduction in the cost of metal finishing. The Air Separator is applied to the compressed air line and absorbs the oil, moisture and the fumes of overheated oil which have previously proved so detrimental in cases where the sand blast operator dons a gas mask and works in the sand blast room.

The Purolator Air Separator has a filtering element of brass and a special alloy of bronze enclosed in a metal case. The element surface is made of a special alloy bronze ribbon, wedge-shaped in cross sections and having rises 0.0005 in. high placed at intervals of $\frac{1}{8}$ in. on one side of the ribbon, the other side being smooth. The ribbon is wound in a spiral around a brass cylinder having fluted sides so that the ribbon, standing on edge and being held apart by the rises, forms a series of slots each with a width of 0.0005 in. and a length of approximately $\frac{1}{8}$ in.

When compressed air enters the sepa-

SHORT RUN STAMPINGS

A process eliminating necessity of making expensive dies.

ALSO PRODUCTION STAMPINGS

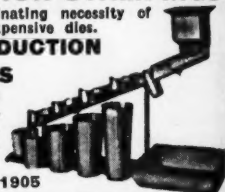
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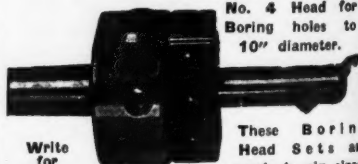
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No. 4 Head for Boring holes to 10" diameter.



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These Boring Head Sets are made in six sizes.

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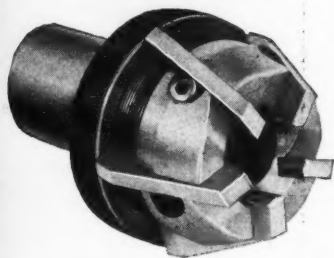
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machines.

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Leading precision file
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SEVEN DIFFERENT STYLES

Have Genesee cut your costs. We design and manufacture hundreds of special and multiple operation production tools. Send samples or blueprints now. Write for catalogue.

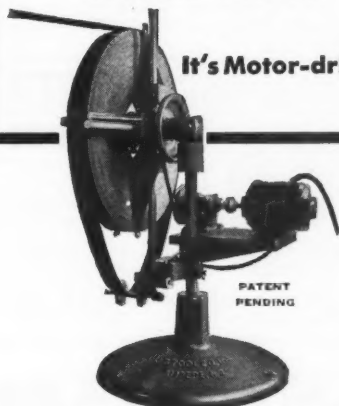
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Now!

an AUTOMATIC Stock Reel

It's Motor-driven



Prevents "WHIPPING"

Automatically maintains a loop

News of importance to many concerns is this announcement of the U. S. Automatic Stock Reel. Important because it means more efficient, economical and trouble-free feeding. Important because it comes from "U. S. Tool"; an assurance that it is built RIGHT.

Especially if you operate heavily loaded reels . . . run long feeds at high speeds . . . or feed light materials such as paper . . . you should not fail to investigate the U. S. Automatic Stock Reel. Its simple motor-driven mechanism ends "whipping" trouble. And it automatically maintains a loop that prevents pull against the reel and the stock.

Mail the coupon now for a descriptive Folder and prices.

U. S. TOOL COMPANY, Inc.

Ampere, New Jersey, U. S. A.

Send the Folder of details and prices on U. S.

Automatic Stock Reels for.....lb. coils
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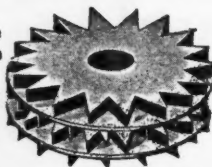
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rator case, it strikes the inside walls of the case and the external surface of the filter element. These parts act as baffles and some of the oil and water is at once removed and drops to the sump in the bottom of the container. The greater part of the separation takes place, however, while the air is pushing through the 26,766 filtering slots in the filtering element.

The space within the cylinder body which is left open is filled with approximately $\frac{1}{2}$ lb. of activated carbon, a 60-



Purolator Air Separator for Sand Blast Air Lines

mesh screen and wool cap being placed at the top of the cylinder to prevent particles of carbon entering the air line. This carbon absorbs the dangerous fumes in the air. Its capacity is extremely large for its physical size and it needs replacement only about once in six months.

**Cesco No. 220 Wide Vision
Chipping Goggle**

The Chicago Eye Shield Company, 2298 Warren Blvd., Chicago, Ill., announces an improved wide vision chipping goggle made for impact hazard work and equipped with a new type super-safety lens that does not change direction of light rays passing through the lens. A number of other practical improvements have been incorporated in this goggle to insure greater safety.

WATCH YOUR PROFITS GO UP with the Wicaco Continuous Oil Grooving Machine

● BECAUSE the Wicaco Oil Grooving Machine is constructed with an upright spindle and a stationary chuck and because the feed lever returns to neutral automatically, when each piece is finished, this remarkable machine can be operated continuously at higher rates of production.

● BECAUSE it is so automatic and so carefully built to close limits it can be operated by unskilled labor.

● BECAUSE the spindle and not the chuck revolves, you may groove large irregular pieces without danger to the operator or causing any vibration whatever in the machine.

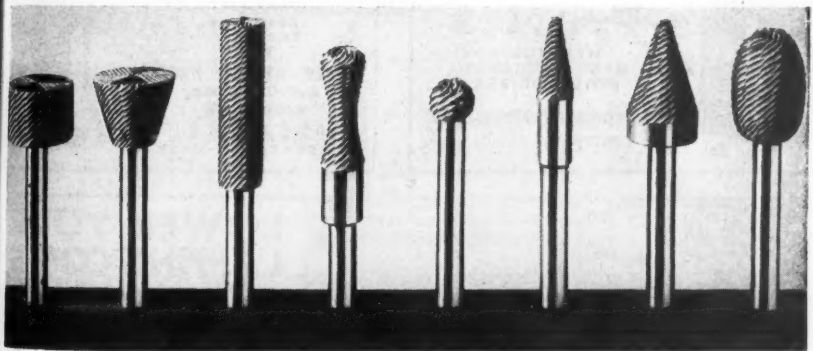
It will cut all standard types of grooves, and the changes from one type to another are remarkably simple and rapid.

Your Oil Grooving profits will substantially increase. Write for Illustrated Bulletin.



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Just a few of the many standard shapes which are carried in stock.

Write for full information.

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DAVENPORT, IOWA

wearing comfort and maximum usefulness. The shape of the eye cup allows natural, full and wide vision.

The goggles are close fitting and edges contacting the face have a pure gum cushion binding. The large curved lenses are interchangeable by means of



Cesco No. 220 Wide Vision Chipping Goggle

a simple hinged door. Super-safety lenses are a scientifically designed optical product and afford maximum protection with no interference to the vision of the wearer. The curvatures are such that the lens is entirely free from focus and the optical center is located so that the line of sight for an eye looking straight ahead through the lens suffers no deviation.

The lenses are made from a high quality crown glass and are free from bubbles and striae. The blanks are first molded to the approximate shape of the finished lens and then ground and polished in accordance with the latest ophthalmic lens practice. The deep curved surfaces of the lens allow an angle of vision far greater than can be obtained in the conventional type of cup goggles. In addition to the optical properties outlined above super-safety lenses are placed through a special hardening process which greatly toughens the glass, enabling the lenses to withstand severe blows and impact hazards.

"Sure Shot" Flux Pot

Welders will appreciate the four-compartment flux pot which is now being marketed by Schlafer Hardware Co., Appleton, Wis. The pot is of sturdy design and made of cast iron; thus it will last indefinitely. A cover is provided which can be locked in place with a locking screw that is provided with a ring for easy handling.

The four compartments provide for four different kinds of flux and enough of each kind for the ordinary welding job. The pot is practically dust-tight.



Greenerd Arbor Presses

HYDRAULIC
HAND OPERATED
MOTOR DRIVEN

Greenerd Arbor Presses
No. 3JR NASHUA, N. H.



KEYWAYS

For Straight or
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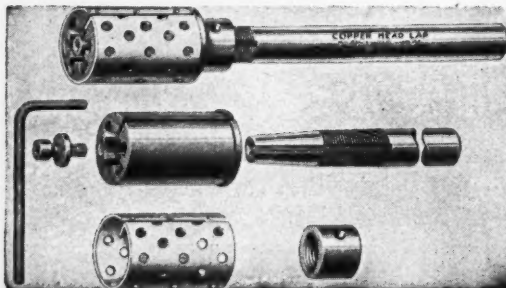
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LOWER YOUR LAPPING COSTS

with Groetchen Copper Head Expansion Laps. Profitably used in hundreds of leading shops. Available in sizes from $\frac{1}{8}$ " to $2\frac{1}{2}$ ", graduated by sixteenths of an inch. Many other designs for special applications.

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Really
Drives
pressure
risk of
wear.

CLE

a high when closed; the flux is kept clean and waste is eliminated. The weight and construction of the pot practically make it impossible to spill the flux and inas-



"Sure Shot" Flux Pot

much as the cover is made so that three of the compartments can be closed while one is open, three of the compartments are protected against dust and dirt while the fourth one is in use. The pot is cadmium plated to prevent rust.

Lincoln Quick-Detachable Cable Connector

A new type of quick-detachable connector, designed for use in connecting welding or electrode cable and which locks in position and cannot work loose nor be accidentally pulled apart, is announced by The Lincoln Electric Company, Dept. E-175, Cleveland, Ohio. This new connector, illustrated here, provides the quickest method of connecting cables. Its operation is so simple that connection can be made in the dark.

To operate the connector, the plug is

EISLER SPOT WELDERS

½ to 100 K. V. A.
ELECTRIC SAW BRAZING
MACHINES, BUTT, WIRE,
PORTABLE AND SPECIAL
WELDERS

Welders as low as \$35.00

Submit Samples for Test.

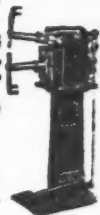
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Eisler Engineering Co.

742 S. 13th St., Newark, N. J.

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Small and Medium Sizes
Accuracy—Prompt Service
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The Taylor Machine Co.

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CLEAN Machinery is SAFE Machinery . .

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BLOWER — SUCTION CLEANER — SPRAYER

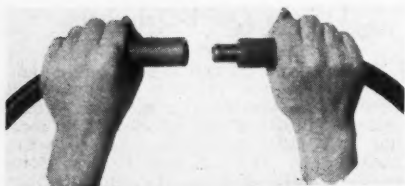
Really **CLEANS** any motors or intricate machinery—thoroughly, safely. Drives **DRY AIR**, free from oil or moisture at great velocity but low pressure. Removes dust, lint, wood or metal particles—reducing risk of "shorts" and "burn-outs", cuts down fire hazard and excess wear. Convertible to sprayer or suction cleaner.

CLEMENTS MFG. CO.,

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Ask for **FREE** Trial



New quick-detachable cable connector for electrode or welding cable announced by The Lincoln Electric Company.

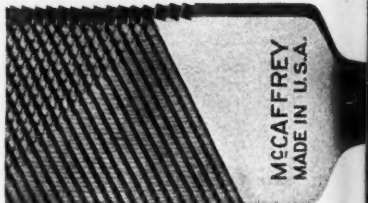
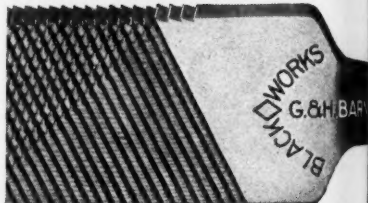
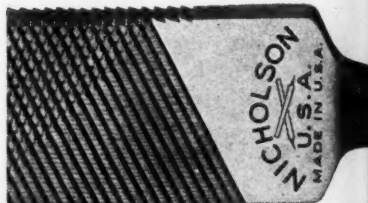
inserted in the jack and a twist of the wrist locks the connection, as shown in the illustration. To disconnect, the procedure is reversed. Protection against grounding is assured by fibre insulating sleeves.

Nicholson Improved Files

The Nicholson File Company, Providence, Rhode Island, announces an improvement in the manufacture and tooth construction of the files made by this firm, now available as finished products in the Nicholson, Black Diamond and McCaffrey brands. In tests made both in the laboratories and in the field on brass, bronze, cast iron, or steels, the

improved files have demonstrated the ability to remove stock at an exceedingly high filing speed. In addition the length of life of the improved file was far beyond expectations.

The method of manufacture and tool construction makes possible up to three times as many cutting edges to a square



Nicholson Improved Files

inch of the file's cutting surface as has been available on files previously made by this company. As the teeth were

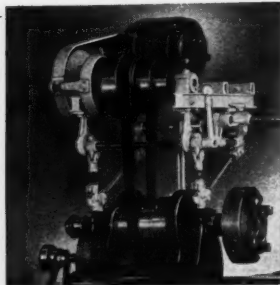


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You can obtain a knee and column type milling machine for high production milling of small parts with a rapid traverse of 400 in. per minute? See page 7.

A four compartment flux pot is now available for welding equipment users? See page 146.

Only one set of chaser holders is required for any right hand thread within the capacity of a new die which has been developed by a prominent manufacturer? See page 5.

Better vision and better production can be obtained by the use of proper light. See page 73.

An accessory which will insure the accurate and smooth operation of air-controlled valves is now available? See page 136.

A new method of file manufacture and tooth construction that has produced what the most critical experts have called the greatest improvement within a generation has been announced by a prominent manufacturer of files? See page 49.

A new line of machine screws and stove bolts with a recessed self-centering head which has previously been applied to wood screws and sheet metal screws is being manufactured by a New England concern? See page 150.

Assembly costs can be greatly reduced with the use of inexpensive universal joint socket wrenches? See page 85.

A grinding attachment can be adapted to a milling machine for small work grinding when no other grinder is available? See page 66.

Pin splice tools permit grinding down to a new edge far beyond the point where conventional tools would be scrapped? See page 75.

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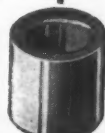
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down in the natural course of filing, reserve cutting edges appear to take their places, practically giving the files a new lease of life. In addition, it is stated that the improved files will adhere to the line of work without skidding or slipping to left or right.

Phillips Recessed Head Self-Centering Screws and Bolts

The American Screw Company, Providence, R. I., is introducing a line of machine screws and stove bolts with the new Phillips recessed, self-centering head which has previously been applied to wood screws and sheet metal screws. In the Phillips head, a tapered recess which exactly fits a tapered driver takes the place of the slot in the conventional screw. It is said that the recess enables faster driving with less effort, provides better holding power, prevents slippage of the driver, and reduces the number of accidents.

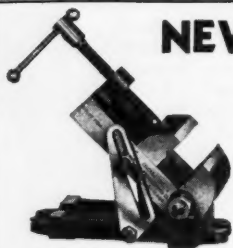
The greater strength of the head in which the Phillips recess is used makes it possible to set the screw tighter without danger of breaking the head. The peculiar design of the recess makes it impossible in many cases to impale the

screw on the point of the driver and start it with one hand, which is of importance when driving screws in difficult places. There is no danger of the driver slipping out of the slot and marring the surface of the work or injuring the hands. It is said that the design of the Phillips head makes it the strongest part of the screw.

Phillips machine screws are available in flat, round, oval and flilbuster heads and Phillips stove bolts in flat, round and oven heads. Only four sizes of Phillips drivers are necessary to drive the entire range of screw and bolt sizes and two sizes of drivers fit the slots most commonly used. Phillips bits are available for all power or manual drivers.



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Armstrong Bros. General Catalog B-35

The new General Catalog B-35 of the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., includes a number of newly-developed tools including a line of permanent multi-purpose tools for turret lathes and screw machines that take standard shaped cutter bits, an extensive line of chrome-manganese steel detachable head socket wrenches and wrench sets with a new "Driverlock" feature, a line of carbide cutters and tool holders, and a line of threading-type pipe threaders.

The "Driverlock" feature of the new wrenches consists of a device for locking sockets to drivers.

The new turret lathe and screw machine tools, embodying in principle the advantage of Armstrong tool holders and consisting of inserted cutters in permanent shank, will undoubtedly have an important effect on shop practice by introducing into a new field permanent, multi-purpose tool holder.

A copy of the catalog is available to any mechanical executive without charge.

MATERIALS HANDLING EQUIPMENT

Catalog No. 417, issued by Jeffrey Manufacturing Co., Columbus, Ohio, contains 400 pages of descriptions of chains, sprockets, transmission machinery, spiral conveyor, elevator and conveyor parts, along with all kinds of parts for other Jeffrey materials handling equipment. The book presents pictorially the line of materials handling equipment engineered, manufactured and erected by

the Jeffrey Company. Specifications and list prices are included. Copy free upon request.

No. 6 FELLOWS HOURGLASS GEAR SHAPER. This four-page folder, issued by The Fellows Gear Shaper Company, Springfield, Vt., presents an accurate means for cutting hourglass worms such as are used for steering gears, camshaft distributor drives, and other forms of right-angle drives for reduction purposes. The mating member of the hourglass worm is a helical gear, cut on the Fellows Helical Gear Shaper. The folder describes the No. 6 Hourglass Gear Shaper and explains the method of oper-



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ation of the machine. Specifications are included. Copy free upon request.

PYRO CATALOG No. 70. This catalog, issued by The Pyrometer Instrument Company, 101-105 Lafayette St., New York, N. Y., explains in detail the uses and advantages of the Pyro Optical

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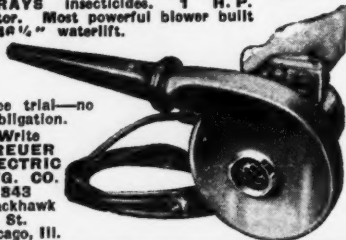
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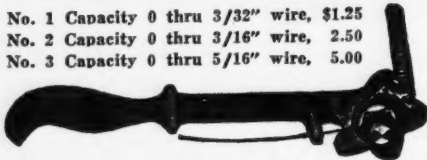
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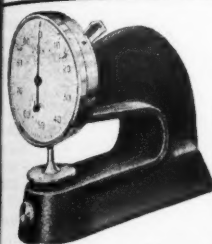
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PRATT & WHITNEY No. 420 CIRCULAR ON GEAR GRINDING. This 8-page folder describes in detail the Pratt & Whitney 10-In. Hydraulic Gear Grinder for spur and production gear grinding made by Pratt & Whitney Company, Hartford, Conn. The development of the gear grinding machine is explained in detail and the reader is given a thorough insight into the operating principles and production method. The hydraulic mechanism is described and illustrated together with other essential parts of the machine. A copy of the folder will be sent free to any mechanical executive upon request.

MANHATTAN CATALOG OF FRICTION MATERIAL. The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., has issued a catalog which describes the complete line of Condor Industrial Friction Materials made by this firm. The text includes technical descriptive data on the nine Condor types which cover every practical friction material requirement together with installation charts, illustrations and diagrams, and list prices. Condor Friction Materials are said to be suitable for use wherever mechanical power is applied intermittently with



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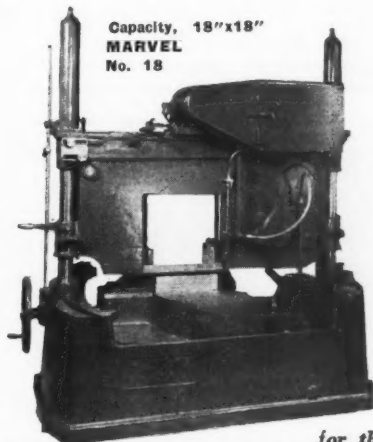
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BARNES HORIZONTAL SELF-OILING HYDRAULIC HONING MACHINE BULLETIN No. 135: This bulletin, issued by Barnes Drill Company, 824 Chestnut St., Rockford, Ill., illustrates and describes the No. 5 Horizontal Self-Oiling Honing Machine which has been developed by this firm. The machine is intended for the finishing of all types of cylinders that can be honed, in sizes that are too large for honing on the vertical type machine. The bulletin shows the machine set up for honing a 5-inch diameter bore in a piece of work 6 feet long but it can be supplied for other work diameters or lengths. Copies of the bulletin free upon request.

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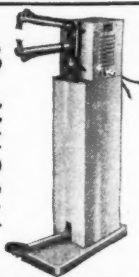
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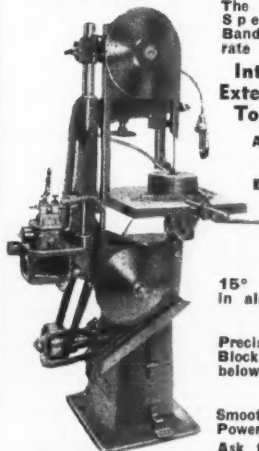
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LATROBE STAINLESS STEEL AND IRON. This 104-page book, issued by the Latrobe Electric Steel Company, Latrobe, Pa., contains a fund of information for the manufacturer who is considering using corrosion-resisting and heat-resisting steels and iron in his product. Characteristics of different types of stainless steels are described to aid the user in selecting the best steel for his use. In addition, the analysis of each steel is given, together with the heat treatment for forging, annealing, hardening, etching, finishing, welding, tempering, pickling, and so on.

The same information regarding stainless irons is included. For each grade of stainless iron a graph, in blue-ink color, is given showing the tensile strength, yield point, elongation, reduction of area, impact, and Brinell hardness. The book closes with a series of useful tables, among which are a table of Coefficient of Expansion of Linear Expansion per Deg. C., a table showing the freezing points of materials commonly used in the heat-treating department. Colors of Hardening Heats, Temper Colors of Stainless Steels, and other color is given showing the tensile

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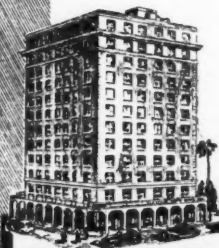
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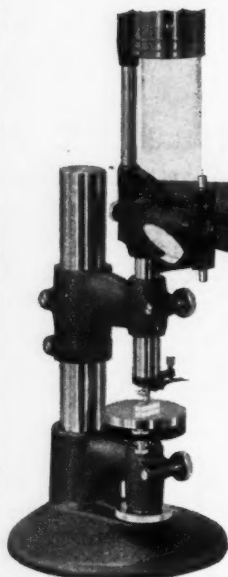
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